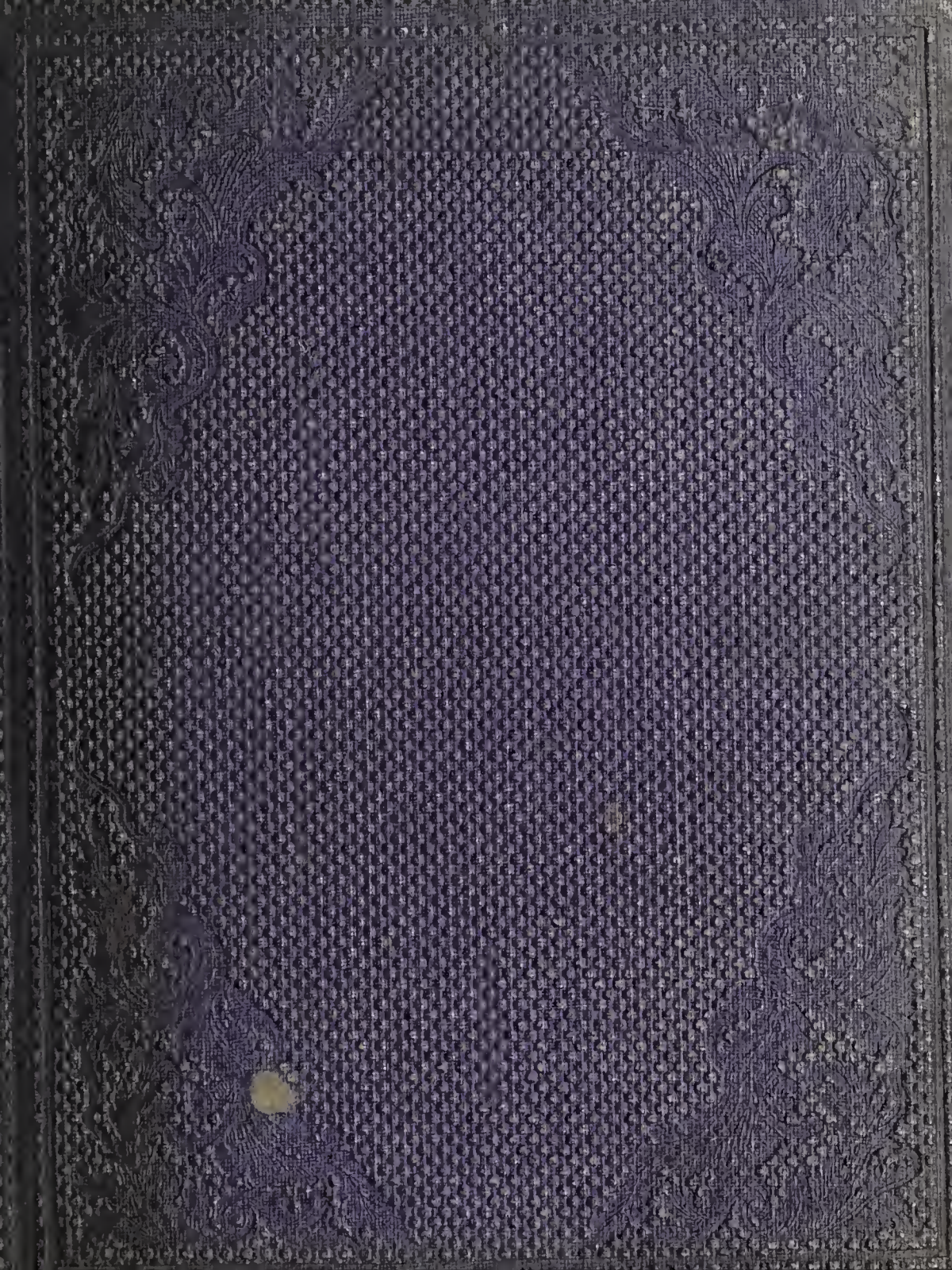




RB02281

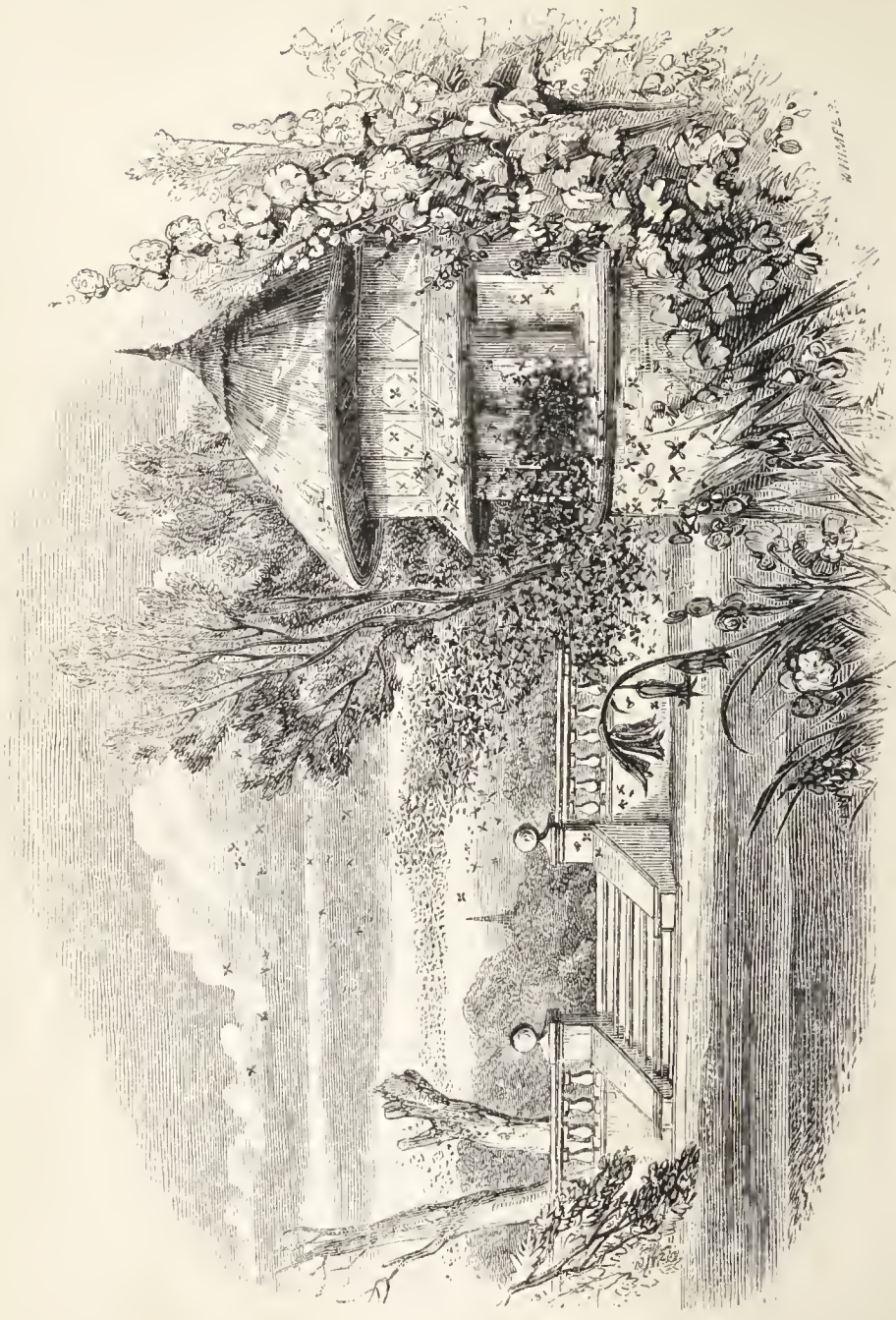


Library
of the
University of Toronto

RF62284

Digitized by the Internet Archive
in 2018 with funding from
University of Toronto

<https://archive.org/details/lifeofinsect02unse>



CHAPTER I.—EMIGRATION OF BEES.

THE
LIFE OF AN INSECT;

PART II.

BEING

AN ACCOUNT OF INSECT HABITS AND MANNERS.

PUBLISHED UNDER THE DIRECTION OF
THE COMMITTEE OF GENERAL LITERATURE AND EDUCATION,
APPOINTED BY THE SOCIETY FOR PROMOTING
CHRISTIAN KNOWLEDGE.

LONDON:
PRINTED FOR THE
SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE;
SOLD AT THE DEPOSITORY,
GREAT QUEEN STREET, LINCOLN'S INN FIELDS;
AND 4, ROYAL EXCHANGE;
AND BY ALL BOOKSELLERS.

LONDON:
Printed by SAMUEL BENTLEY & Co.
Bangor House, Shoe Lane.

TO

WILLIAM SPENCE, ESQ., F.R.S., F.L.S.,

ETC.

THE WRITER OF THESE VOLUMES ON INSECT LIFE

DESIRES TO EXPRESS HIS

GRATITUDE FOR HIS KINDNESS AND VALUABLE ASSISTANCE

IN THEIR

REVISION AND PREPARATION FOR THE PRESS.

Chelsea, 1850.

CONTENTS.

PART II.

PAGE

CHAPTER I.— <i>The Emigrants</i> .—Emigrating Fever—The Bees—Note of Preparation—Preparing to Depart—The Departure—The Explorers—The Settlement—Driver Ants—Expeditions of—Attack upon—A Ladder of Insects—City on Fire—Emigrant Ants—Emigrant Glow-worms—Water-boatmen—Aphides—Armies of Lady-birds—Hosts of Butterflies and Moths—Bugong Mountain—Migrations of Locusts—At Sea—Motives and Causes—Final Cause of Emigration among Insects—The Lemmings—Destruction of the Insect Wanderers	1
--	---

CHAPTER II.— <i>The City</i> .—Social Insects—Constitution of Insect Society—A City in a Garden—The Queen, her Subjects, and Followers—Making a new Queen—Birth of the Sovereign Princess—A Royal Duel—Customs of the Citizens—Building the City—The Materials—The Size and Form of the Houses—Architecture of the City—Warming and Ventilation—Cleanliness of—The City Attacked—Fortifications—Vast City—Cities of Wasps—Cities of Ants—Queen Rufa—Her Subjects—The Young Ones—The Great Ruler—Other Insect Societies—City of Caterpillars—End of their Community—A City of Silk—Insect Republic—Danger of the Examination—Butterfly City—Imperfect Societies—Duration of Insect Governments	43
---	----

CHAPTER III.— <i>The Cell</i> .—Human and Insect Hermits—Cell of Mud—Cell in a Bank—A Stony Dwelling—Escape of the Captive—Insect in an Apple—His Life—Moveable Houses—Towers of Stone—Perambulating House—Houses Thatched—A Hot Abode—Cell in a Field—Cell of Mole-Cricket—Trap-door Larva—A Night Marauder—Australian Insect—An Insect Miner—Insect Hercules—Tailor Caterpillars—Coat of Colours—Variety of Dwellings—End of the Cell-life . . .	94
CHAPTER IV.— <i>The Battle-field</i> .—The Reign of Peace—The Field of Conflict—The Arms—The Warriors—The War—The Enemy at the Gates—Death-struggles—Guerilla Warfare—Battle of Single Combats—End of the Fight—A Battle in the Air—Warrior Termites—Attack upon their City—The March—Wars of Bees—Frightful Massacres—Another Battle—Virgil's description—Battle between Man and Bees—Locusts and Man	142
CHAPTER V.— <i>Insect Duels</i> .—Nature and Cause of the Duels—The Contest—Fighting Father-Longlegs—The Stag-Beetles—Duel of Beetles—Butterflies—Consequences—The Bombardier—Artillery and Smoke—The Weapons—Spider-Duels—Scorpions—Battles of the <i>Mantes</i> —Duel in a Basin—Duels of Mason-bees—Hornets Fighting—Aërial Duel—Ferocious Spider—Object in View	178
CHAPTER VI.— <i>Insect Gambols</i> .—Happiness of Insects— <i>Gyrinus natator</i> —A Water Party—Sports of Ants—Dances—Vast flights of Insects—Columns of Insects—Clouds of Dancers—Humblings in the Air—Butterflies at Play—Playfulness of Stag-beetle—Pastime of a Fly	210

CHAPTER VII.— <i>Language of Insects</i> .—Organs of Speech —A Royal Speech —Spreading of News —Loss of a Queen —Remarkable Experiment—A Captive Monarch—Friendly Visits —The Antennæ—Antennal Language—Conversations of Ants —News of an Attack —Language in Time of Peril —Remarkable Action —Anecdote by Dr. Franklin —Other Signs—Fabulous Ideas on this Subject	233
CHAPTER VIII.— <i>Music of Insects</i> .—Music of the Hearth —A Serenade —Music of the Fields —The Instruments —Locust Musician—A Violinist—The Cicada a tremendous Vocalist—The Galangs—The Cicada's Timbrel—Method of performance —Sounds of Terror —The Lyre-Player	265
CHAPTER IX.— <i>Instinct of Insects</i> .—Definition of the Term —Invasion of a side-board—Remarkable Feat —Intelligence of Bees—An Herculean Exploit—Bees in glazed Hives—Alteration of the Cells—A Snail Entombed—Instinct of a Larva —Intelligence of Insects —Anecdote of a Larva —Singular Habit of a Spider	288
CHAPTER X.— <i>Insect Rapine</i> .—An Insect Hunter—Spider hunting a Fly —Tiger-like Manœuvres —An Insect Pirate —Voracious Spiders —An Anxious Mother —Bird-Hunting Spiders —Obstinacy of the Driver-Ants—Expedition against a Fowl —Its Success —The Cowardly and Cruel Mantis —The Pirate of the Pool—The Deathful Earth	313
CHAPTER XI.— <i>Insect Miscellanies</i> .—A Dead Queen —Insect Affection—Affection of Humble-Bees —Insect Anger —Cleanliness —Sleep of Insects—Insects tamed—Wonderful Fleas	

—Tame Spiders —Shawl woven by Insects!—A Dress woven by Insects —Veils made by Caterpillars —Light Insects— The Fire-fly—Stars of the Earth—Queen of the Fire-Flies —Insect Jewels —Mistakes caused by Fire-Flies — Electric Insects	336
--	-----

CHAPTER XII.— <i>Insect Diseases and Death</i> .—Sicknesses of In- sects—Giddiness of the Head—Diseases of Bees—Medicines— A Sick Caterpillar—Insects destroyed by Fungi—Vegetating Wasp—Singular Fungi—Insects poisoned—Burying-Beetles —Insect Sextons—Insect Funeral—Interment of a Bird— A Royal Death-Bed—Death	363
---	-----

DIRECTION FOR PLACING THE PLATES.

CHAPTER.	PAGE
I. EMIGRATION OF BEES <i>frontispiece.</i>	
II. THE CITY	43
III. THE CELL	94
IV. THE BATTLE-FIELD	142
V. INSECT DUELS	173
VI. INSECT GAMBOLS	210
VII. LANGUAGE OF INSECTS	233
VIII. AN INSECT CONCERT	265
IX. INSTINCT OF INSECTS	288
X. INSECT RAPINE	313
XI. INSECT MISCELLANIES	338
XII. INSECT DISEASES AND DEATH	363

THE
LIFE OF AN INSECT.

CHAPTER I.

THE EMIGRANTS.

INSECT Emigrants,—whither bound? Where lies their native country, and what are the causes which have compelled them to quit it for an untried world? Has over-population rendered the land too strait for them, or has dearth of food imperiously required their removal to a more fertile soil? These interesting inquiries, so strange in their connexion with creatures commonly considered so insignificant as insects, it is the purpose of the present chapter to discuss. We shall find that wise principles of political

economy have been impressed upon the tribes of insects by their Divine Creator; and that in the social history of beings far beneath man in created excellence and attributes, most astonishing features are to be traced assimilating them in various remarkable points to creatures fully endowed with mind, memory, and reason.

In a former part of this work, the various stages through which the insect passes up to the perfect being, have been successively considered. The life of an insect has been watched from the egg to the winged creature, whose sporting-place is the unbounded field of air. The anatomy and physiology of insects have also been discussed; and occasional glances have been taken at the singular habits and propensities of insects in the conditions of *larva*, *pupa*, and *imago*. Our present task is yet more pleasing. We have to treat of the habits and manners of these interesting beings; and it will be our delightful occupation to unfold such singular traits in their character, and such wonderful phenomena in their private and public life, as must entitle them to our highest admiration, or even to our respect. We have to exhibit the insect tribes emigrating,

colonizing, building cities, ambuscading, fortifying, duelling, fighting the most terrible battles, and in almost all respects, imitating the proceedings of what we are pleased to call civilized life. As we proceed may we be always in remembrance of that Great and Glorious Being, who, as if to confound human wisdom, has endowed these tiny creatures with instincts which enable them to accomplish their purposes with a degree of wisdom, ingenuity, and perseverance not surpassed by man himself.

We have first then to consider the singular fact of insect emigration. In these times, when every week bears away from our shores numbers of our fellow-countrymen to a larger country, and to better fortunes, how strange the thought, that for thousands of years the insect world has furnished us an example of its members seeking a similar relief to an over-teeming parent country, and to the pressure of the times. Impelled by an instinct given from above, their legions have year after year passed in emigrating bands through our forests and fields. Ere the first family of man dispersed on finding their dwelling-place too limited for their necessities, before the sepa-

ration of Abram and Lot, and of Esau and Jacob, because the land could not bear them, "so great was the number of their families and flocks;" insects, taught of God, sent out their colonists, and relieved the scarcity of their first birth-place by the dispatch of myriads of emigrants. The most frequent causes of insect emigration are, either want of room, or want of food. But, at times, as we shall have to observe, immense crowds of emigrants are seen, upon the cause of whose movements very little light has as yet been thrown. In ordinary cases, when the insect tribe finds that its numbers are becoming too great to be accommodated within the common habitation of the people, or when the ordinary supplies of food are insufficient to meet the demand of the overflowing population, emigration becomes the remedy, and it is generally adopted by them without further delay. How the councils for this important step are summoned, how each individual becomes impressed with the perhaps painful fact that it must soon bid adieu to its father-land, and to the comfortable dwelling in which it had spent the happy hours of infancy and early maturity, how the whole

population is in like manner impressed, and, as with one mind, resolves to adopt this measure of relief;—we may not tell. Although they have public meetings, at which great excitement is displayed, and although the head of every insect seems turned with the emigrating idea, so that they forget what they are about, and in the anxieties of the future lose their sense of the duties of the present, yet we hear not of any insect orator swaying multitudes with the force of his arguments, or the eloquence of his speech, and all the other means of agitation common among the superiors to insects, are, of course, unknown to them. By what means soever it be, of the fact itself there is no doubt, neither can we doubt, that every emigrant, little though we can comprehend his sensations, is, for the time being, wholly absorbed with this idea, and this alone. In our desire to explain what we cannot understand, we call this *instinct*; but, alas! it is only a term under which we satisfy our pride, and shelter our real ignorance. It is time, however, that we bring these wonderful little beings upon the scene.

On a warm evening, in the early days of June,

if we bend our steps in the direction of a range of bee-hives, we may perchance be so fortunate as to hear the foretokens of a bee emigration. As if discussing the approaching vastly important epoch in their history, as a community, and the probable advantages of a different locality, on one of these hives were to be seen, for a few evenings before, one or two little knots of bees. In what light we are to regard these little assemblies it is difficult to say, and the historians of the bee-people omit to state whether they hold these preliminary meetings to take counsel with one another, or simply to enjoy the cool evening air, as the days are now growing excessively warm. There can be little doubt they have some connexion with the approaching expedition, for it is at this very time that our steps are now arrested by hearing the "note of preparation" sounded from within. On other nights we should listen in vain for a sound from the silent city of the bees; and in the other hives the winged myriads are asleep and silent. But from this hive issues a low, ceaseless hum, and on carefully listening we should distinguish sounds of confused origin, sounds of

tumult and bustle, and we might look every moment for the sudden appearance of the whole population at the gates of the city. This sound is the sure forerunner of the emigration movement. It is hard to say what it can be. Are the bees busy packing up previous to their removal? Are they bidding farewell to those who are to be left behind? Are they encouraging every one his brother, or are they holding some grand council relative to this public expedition? It has been said, indeed, that this sound is a royal speech made by the queen bee to her affectionate subjects. If so, it is much longer than the harangues of earthly sovereigns are wont to be, for it ceases not all through the night, and her subjects must be considered excellent listeners, for not a moment's sleep do they permit to themselves the night through. Leaving, however, the queen in the midst of her discourse, if it so be, or her subjects in the midst of their packings up, leave-takings, and mutual conversations, we must come the next day at noon, if we would watch the departure of the emigrants.

As night wears on, the emigrants bustling to

and fro with an air of infinite anxiety, prepare to take the final step, awaiting only the arrival of warm and genial sunlight to depart on their expedition. The day dawns, yet not an emigrant appears; and the sunbeams pour in golden richness through the gate of the bee city, yet its inhabitants appear resolved not to quit its precincts. The murmur and confusion within do not cease, and it is very evident that a great ferment is taking place among the population, although nothing of it appears outside. Noon-tide comes, and the fervid sunbeams light upon the city of the bees, raising its temperature, and not diminishing the fume into which the bees have wrought themselves. The great moment has at length arrived. Suddenly, a tumult more violent than before is created in the hive, and now along the avenues of the city a scene of the wildest excitement is presented. Hither and thither fly the labouring classes of the community, rushing to and fro as if bewildered. There is a cessation of all business to the remotest extremities of the city, and from the monarch herself, down to the meanest of her subjects, there is not one individual who is not absorbed by the

vast concerns of the moment, to the entire neglect of all their customary duties. A rush is now made by the queen and her subjects to the city gate, and instantly there emerges from it so dense a stream of emigrant insects, as to defy the powers of enumeration. Thronging crowds come hastily out, and in company with the queen rise and fill the air.*

Before following them to their new abode, it is necessary we should go back and state a little circumstance which might have been noticed a few days prior to this grand movement of emigration. At a little distance from the city of the bees, stood two aged trunks; which, by the influence of time and decay, had become hollowed, so as to present a convenient shelter from the inclemencies of the weather, and these hollow recesses communicated with the external air by a suitable passage. Altogether, and considering, too, that the odorous perfume of such flowers as bees love to riot in, came wafted thither from a garden plot close by, either of these hollow trunks formed a very appropriate spot for the settlement of the emigrant bees,

* This scene is represented in the Frontispiece.

oppressed at home with the heat and overcrowded state of their city. To both trees, it became evident a scientific body of exploration had been sent by the bees. The explorers might have been seen, at the time of which we speak, making the most minute investigation of the interior and exterior of the trunks. The soundness of the walls was duly examined, and the proportions of the cavity were accurately surveyed. Crevices were penetrated, and deep deliberations as to the weather-proof character of certain suspicious parts appeared to be entered into. The scientific party returned, it may be, to publish to the expectant emigrants at home, their report as to the capabilities of the new territory they had explored. Again and again did they return to renew their investigations, and to obtain, if possible, fresh evidence of the suitability of the situation to the requirements of the bee population. The choice was at length made, and no civil engineer could have found, of those presented to their selection, a more excellent site for a colony than the exploring bees had determined on. The hour of departure arrived, the explorers led the way, and, followed by a winged host of bees,

sought and took possession in the queen's name of the locality they had previously selected. Here, a new empire was founded and a new city built, which in a short time teemed with population, and was ultimately compelled to adopt the same method of relief, which had led to its first establishment — by throwing off a swarm of emigrants.

In the case of the bee-emigration, it is only a part of the population which quits the city, and the remainder proceed, after their departure, in the fulfilment of their ordinary duties. But we have instances in the Insect world, of whole nations of emigrants, of insect tribes having no settled country, like some of the wanderers of the human race, and passing from one spot to another almost indifferently. The exact cause of the migrations of such tribes can scarcely be defined. The abundance or scarcity of food is, however, the chief circumstance leading to the occupation of a new, or the desertion of an old locality. One of the most remarkable examples of this class of insect emigrants is that of the Driver Ants of West Africa, a highly interesting account of which has been given by the Rev.

Thomas S. Savage, of Cape Palmas, in West Africa. These remarkable insects have also been called the Visiting Ants, and various accounts of their habits have been published from time to time.

These wandering insects appear to have no fixed habitation. Their temporary encampment, like the gipsies of our own species, is generally in the woods, under shelving rocks; or in a hollow over-arched by the roots of trees. They give themselves no trouble in its embellishment, and avail themselves of the rude shelter such positions may afford, without any attempt to add to the natural advantages accidental to the spot. No leisure have they for works of art, or appliances of civilised life. Their house is a den of robbers, and by its confused and unmitigated savageness indicates the nature and occupation of its tenants. They have neither cells nor magazines, nor the other interior arrangements exhibited in the abodes of other insect nations. Dwelling in rocks, caves, and fissures of the earth, they are in a moment ready to arise, and emigrate on the first call of necessity, or pressure of events. Their emigrating expeditions are chiefly

made in cloudy days, or in the obscurity of the night. Like robbers they prefer the hours of darkness, and while the rest of creation is asleep, the whole population of the Drivers will be up and stirring, and, ere the morrow's sun, will have deserted one abode, and taken up their residence in another.

Their mode of emigrating is extremely curious, and may well claim our admiration. Exposure to the sun's rays is highly dangerous to them, and is not unfrequently almost instantly fatal. In their march they have, therefore, to guard against their power, which they do in a very singular manner. It may so happen that, spite of their precaution in travelling over-night, the morning sunbeams break upon the world, finding them still in transit. In this emergency they will construct covered ways, or arches, over their path, by moulding a portion of earth with a glutinous fluid excreted from their mouth, and in the tunnels thus constructed they pass with safety from one region to another. If their way, however, possesses any natural advantages which can be turned to the same account, the tunnels are not formed, and the emigrant legions

will pass under the shelter of dense herbage, or sticks, unscathed by the fierce luminary which is their most formidable foe. In cloudy days they adopt a yet more singular expedient. To construct an earthen arch seems scarcely warranted, since the power of the sunbeam is scarcely perceptible. Yet even to its enfeebled rays the tender bodies of the *pupæ*, or young, of the nation cannot be safely exposed: they therefore construct an arch of the bodies of the largest class. Their widely-extended jaws, long, slender limbs, and projecting antennæ intertwinning, form a sort of network that seems to answer well their object. Whenever an alarm is given, the arch is instantly broken, and the ants joining others of the same class on the outside of the line, who seem to be acting as commanders, guides, and scouts, run about in a furious manner in pursuit of the enemy. If the alarm should prove to be without foundation, the victory won, or danger passed, the arch is quickly renewed, and the main column marches forward, as before, in all the order of military discipline.

Let us now mention an attack upon these formidable emigrants, instituted by the narrator

of their habits, from whose account we have been quoting. At one time the drivers literally drove out every member of the female department of the school with which Dr. Savage was connected; at another the male department; then the inmates of his own dwelling. They then attacked the horse, pigs, fowls, &c. &c.; nothing in short, possessing animal life, escaped their assaults. They always made their expeditions at night, sometimes sending two or three as an advance guard, who might be seen lurking about in a suspicious manner just at nightfall. A resolution was at length taken to discover their habitation, and to destroy the whole population by a *coup de main*. Beneath a shelving rock of decomposing granite their temporary dwelling-place was discovered. They had been roused by the noise and efforts of the workmen, and had come forth in incalculable numbers for defence, literally blackening the surrounding grass and shrubbery. Lines of ants going and coming, agreeably to the rules of their order, were running in opposite directions. Their paths were very distinct and well trodden, of about an inch in width. In other directions were seen covered ways forsaken, the object of their

formation no longer existing,—no prey having been discovered, or if found being disposed of,—and other regions lying open for exploration. Their numbers could not be computed: millions on millions seemed to be there, besides thousands that were going and coming, with astonishing speed and alacrity. A quantity of dried leaves and other combustible matter was collected and ignited on the spot, producing a fire of great intensity, which continued to burn for a considerable time. This was to be the end of the annoyance.

But, vain hope! Two days after, a tree at a short distance, to the height of some feet from the ground, together with the adjacent plants and earth, was perfectly black with them. Thick festoons of insects hung down to the ground, upon which numbers were ascending and descending. “One of these festoons,” writes Dr. Savage, “I saw in the act of formation: it was a good way advanced when first observed; ant after ant coming down from above, extending their long limbs and opening wide their jaws gradually lengthened out the living chain till it touched the broad leaf of a *Canna Coccinea* below.

It now swang to and fro in the wind, the terminal ant the meanwhile endeavouring to attach it by its jaws and legs to the leaf. Not succeeding in so doing, another ant of the same class, the very largest, was seen to ascend the plant, and fixing his hind legs with the apex of the abdomen firmly to the leaf under the vibrating column, then reaching forth his fore legs, and opening wide his jaws, closed in with his companion from above, and thus completed the most curious ladder in the world."

They had migrated from the burning city to this spot, there being evidently a cavity under the tree. It proved to be too small for the population, and a large number were now busily engaged in extending its dimensions. In a little while their new abode was fully occupied, and excursion parties were already out in the thicket for food, their course being easily followed by their beaten track and arched way. Their new abode was then fired, and presently emerging from the flaming trunk, their order unbroken by their frightful position, surrounded by the crackling flames, the heat and the smoke, appeared legions of the drivers, now compelled to emigrate elsewhere.

As it was a wet and cloudy day the covered way was not adopted, but the larger class arranging themselves on either side in an arch of living bodies, formed the substitute. Under this arch, armed on all sides with sharp claws, and fixed, hooked, open jaws, the feebler part passed rapidly forwards in conscious safety. The baggage of the emigrants consisted of the helpless pupæ, which they carried longitudinally in their mouths and between their legs, or of prey which they were too good economists to leave behind. Here and there a driver emigrant would be found with a load two or three times larger than himself, yet he seemed little incommoded thereby, and his pace was not a whit slower than that of his brethren. Although their numbers must have been thinned by many thousands by the two conflagrations, yet thousands of thousands still remained, forming a long line of emigrants extending far from their last unfortunate locality.

Difficulties which would damp the courage of emigrants of our own species, are met and overcome by the drivers without hesitation. It may happen that a current of water runs exactly across their course, and this puts their ingenuity

to the test. If it is too extensive for them to fetch a compass around, they, without fear, cast themselves into its waters, and so form a line or chain of living floating bodies, over which the whole population passes in safety. Sometimes they are compelled to emigrate by the sudden rise of the floods. In this emergency they form themselves into a rounded mass, depositing the young, the pupæ, and eggs, in their centre, and then entrusting themselves to the tumultuous waves, which float them in safety to a new region. What is, perhaps, the most remarkable feature of these interesting insects is the fact that they appear to be totally blind! All these wonderful proceedings are the acts of creatures, in which, after a most careful examination, the slightest indication of eyes cannot be discovered.

We need not visit West Africa for annals of insect emigration, when, in our own fields, a scene, not less interesting, is to be witnessed by any attentive observer of the habits of the red ant, or hill ant (*Formica rufa*). "Having, one day," writes M. M. P. Huber, "deranged the habitation of a colony of fallow ants, I perceived

that they had changed their domicile. I saw at the distance of ten paces from their nest, a fresh ant-hill, which communicated with the old by a path struck out in the grass, along which the ants were passing and repassing in great numbers. I remarked that all those going towards the new establishment were loaded with their companions, whilst those moving in a contrary direction were running one after the other; these were, no doubt, returning to the old nest, to seek inhabitants for the new." The further observations of Huber on this emigration are told so agreeably by Messrs. Kirby and Spence, that we shall transfer their account to our pages.

"The first step is to raise recruits:—with this view some of the neuters who have explored the spot, eagerly accost several fellow citizens of their own order, caress them with their antennæ, lead them by their mandibles, and evidently appear to propose the journey to them. If they seem disposed to accompany them, the recruiting officer, for so he may be called, prepares to carry off his recruit, who, suspending himself upon his mandibles, hangs coiled up spirally under his neck; all this passes in an

amicable manner after mutual salutations. Sometimes, however, the recruiter takes the other by surprise, and drags him from the ant-hill without giving him time to consider or resist. When arrived at the proposed habitation, the suspended ant uncoils itself, and quitting its conductor, becomes a recruiter in its turn. The pair return to the old nest, and each carries off a fresh recruit, which being arrived at the spot, joins in the undertaking: thus the number of recruiters keeps progressively increasing, till the path between the new and the old city is full of goers and comers, each of the former laden with a recruit. . . . This extraordinary scene continues several days; but when all the neuters are acquainted with the road to the new city, the recruiting ceases. As soon as a sufficient number of apartments to contain them are prepared, the young brood, with the males and females, are conveyed thither, and the whole business is concluded."

When the new site is at a considerable distance from the old, these ingenious emigrants construct little resting-places by the wayside, in which they deposit the recruits and tenderer part of the population. These are, however, generally con-

ducted hence after they have recovered the fatigues of the journey to the grand settlement. Sometimes, however, these resting-places are chosen as the site of smaller colonies, and between the new and old colony several of these smaller permanent settlements may occasionally be seen. Like good emigrants, however, they never lose sight of their parent country, nor cease to maintain the closest and most friendly intercourse with it. It might be imagined that a movement so important as this would make a vast sensation in the parent community: but on the contrary, no sensation appears to be felt by the parent city, although daily its inhabitants are becoming thinned by those active emigration agents, the neuters. No duty is interrupted, and all the affairs of the insect government proceed with their customary punctuality and dispatch. The recruiting continues, however, and finally, the seat of government, which is of the republican order, is absolutely removed to the new colony. The causes which appear to lead to this emigration, are generally the operation of some local circumstances calculated to make their original residence either dangerous or uncomfortable

to them. If a community of ants is disturbed by man, or by other animals, or if by some alterations in the ground on which they dwell they become exposed to the severities of the weather, and a more convenient station has been detected by some of their number, emigration is generally the result.

Both ants and bees are insects which live in societies. But insects which do not ordinarily live in a society of their fellows will frequently unite together and form one great company for the purpose of emigration to a different soil. Mr. Knapp informs us that the common glow-worm may be sometimes seen emigrating in warm summer evenings, and he has given a pleasing account of the movement of these insects. "The evening was warm and dewy, and we observed on the bank multitudes of small evanescent sparks in the grass. The light displayed was very different from that which glow-worms exhibit in the warm summer months. Instead of the permanent green glow that illumines all the blades of the surrounding herbage, it was a pale transient spot visible for a moment or two, and then so speedily hidden, that we were obliged, in order to capture

the creature, to employ the light of a candle. The number of them and their actions, creeping away from our sight, contrary to that half lifeless dulness observed in summer, suggested the idea that the whole body had availed themselves of this warm moist evening to migrate to their winter station. A single spark or so was to be seen some evenings after this, but no such large moving parties were discovered again. If we conclude that the summer light of the glow-worm is displayed as a signal taper, the appearance of this autumnal light can have no such object in view, nor can we rationally assign any use of it to the creature itself, unless, indeed, it serve as a point of union in these supposed migrations, like the leading call in the flight of night-moving birds. The activity and numbers of these insects, on the above-mentioned evening, enabled me to observe the frequent presence and disappearance of the light of an individual, which did not seem to be the result of will, but produced by situation. During the time the insect crawled along the ground, or upon the fine grass, the glow was hidden; but on its mounting any little blade or sprig of moss, it turned round and presented the

luminous caudal spot, which on its falling or regaining its level, was hidden again.”*

Sometimes the little insects called the water boatman (*Notonecta glauca*) will migrate in immense numbers, and fall from the air as thick as hail. In the evening of a pleasant day in September, 1846, Sir G. Simpson encamped for the night on his route from Red River to the head waters of the Mississippi. While supper was preparing he perceived something falling on his hat like drops of rain; but as there were no clouds to be seen, he of course presumed it could not really be rain. On looking on the ground near the fire, he saw distinctly that the falling substance, instead of being rain, was a small winged insect, which, although unable to fly, had yet life and motion. The number rapidly increased so as to give great annoyance by falling into the frying-pan, and supper vessels, and continued until the ground was covered by the shower. On the following morning Sir George ascertained that this extraordinary shower extended at least from twenty-five to thirty miles in the direction he was travelling. No informa-

* “Journal of a Naturalist,” p. 294.

tion could be obtained as to its extent in other directions. It was observed that soon after the shower, the weather changed suddenly from warm to cold. It appears therefore probable that the whole of this prodigious flight of emigrant insects must have suddenly encountered the cold current, and becoming paralysed, were precipitated to the ground. They all died soon after falling. In no instance did they revive, even though brought into a warmer atmosphere. The same circumstance, on a smaller scale, has been noticed in our own country; showers of these little insects have been observed falling from the air into pools of water. Sometimes they have apparently mistaken the glistening surface of a conservatory for the appearance of water, and plunging downwards upon the glass, have imitated the sound of a shower of hail.

Those common little insects, which are so often the pest of the green-house, and the enemies of our rose, currant, raspberry trees, geraniums, and other plants,—the aphides, occasionally emigrate in immense numbers. The naturalist of Selborne, Gilbert White, has put on record a memorable shower of these insects. About three

o'clock in the afternoon of a very hot day in August 1785, the people of the village were much surprised by the falling of a multitude of these aphides. Those who were walking in the streets at that juncture, found themselves covered with them. They also settled on the hedges and gardens, blackening all the vegetables where they alighted. "My annuals," observes Mr. White, "were discoloured with them, and the stalks of a bed of onions were quite coated over for six days after. These armies were then, no doubt, in a state of emigration, and shifting their quarters; and might have come, as far as we know, from the great hop plantations of Kent or Sussex, the wind being all that day in the easterly quarter."

The aphides feed largely in the hop plantations, and by their numbers not unfrequently ruin the prospects of the hop-grower. Yet they sometimes wander in immense bodies from these localities, and are found by the dwellers on the sea-coast. They also migrate from one species of plant to another. The very insect which destroys the hop plant, migrated to it from the sloe tree, which is its proper dwelling place. It

has therefore been recommended, with the view of preserving the hop, to cut short this fatal emigration by carefully inspecting the sloe-trees in the vicinity of hop-grounds, and destroying the intending emigrants before their change to more luxuriant quarters. In winter a species of aphid dwells and feeds upon the furze; but when summer comes, and when, to reward the agriculturists' toil, the fields stand thick with healthy bean-stalks, this insect determines to better its quarters, and migrates from the less agreeable position, in which it has so long continued, to the green feast spread before it in the neighbouring fields.

But the aphid army is not permitted to spread its devastating emigrant hordes without a check. This slow and sensual creature, which seems only born to eat and die, and is generally gorged so immensely as scarcely to be able to move a step, has numberless enemies. Among them the most active are the lady-birds, which appear to determine on emigrating too wherever the aphides emigrate. Some years ago they swarmed in innumerable multitudes upon the coast of the counties of Kent and Sussex, having migrated

thither apparently in hot pursuit of the aphides from the adjoining hop-grounds.

In August 1847, Brighton was swarmed with lady-birds. They were crushed by thousands upon the pavement of the Grand Parade, and the adjoining streets. The houses, the fences, and even the clothes of all the pedestrians were dotted thickly over with these insect emigrants. Between four and six o'clock on a Thursday evening, a long cloud, reaching some few miles across the sea, was observed by many hundred spectators, from the heights of Ramsgate and Margate, bending its course to our southern coast from the direction of Calais and Ostend. It presented the appearance of a long column of smoke from a steamer on a calm day. About ten o'clock in the evening, the excitement of the spectators was intensely increased by their becoming literally covered with lady-birds. Many of those who had been most exposed, on their return to their homes, found themselves so completely enveloped with these little insects, and that in so much regularity, that they had the appearance of being clad in scale armour! At an early hour in the morning, the whole of the

line of coast was found to be covered by them to the great annoyance of all parties. Five bushels were swept from Margate Pier, and nearly the same from that of Ramsgate Harbour. To walk on them might be readily compared to walking on snow on a frosty day. The locality whence they first took flight remains unknown.

Occasionally butterflies associate together, and get up a great emigration movement. One of the largest of these emigrant flights probably ever seen in this country, crossed the channel from France to England, in the month of July, 1846. Such was the density and extent of the cloud formed by the living mass, that it completely obscured the sun from people on board our continental steamers on their passage for many hundreds of yards, while the insects strewed the deck in all directions. The flight reached England about twelve o'clock at noon, and dispersed themselves inland and along the coast, darkening the air as they went. During the sea-passage of the butterflies the weather was calm and sunny, with scarce a puff of wind stirring; but an hour or so after their arrival in England a violent storm ensued from the South West, the direction

from whence the insects came. Prodigious flights of the common cabbage-butterfly, the passage of which occupied two hours, have been seen by various observers. A writer in the Royal Military Chronicle states an analogous circumstance which took place in Brazil, in March, 1803. For many days successively, there was an immense flight of white and yellow butterflies, probably of the same tribe as the cabbage-butterfly. They were observed never to settle, but proceeded in a direction from north-west to south-east. No buildings seemed to stop them from steadily pursuing their course, which being to the ocean, at only a small distance, they must necessarily perish. It was singular that at the time of their transit, no other kind of butterfly was to be seen, though at other times the country abounds in a great variety of these insects.

Flights of moths are occasionally noticed under circumstances rendering it positively certain that they must be in the act of emigration from one region to another. A remarkable instance of this kind is narrated in the Magazine of Natural History, vol. iii. p. 404. About seven o'clock in the evening of a sultry gloomy day in August

the air being peculiarly damp and oppressive, a moth of a rare species, called the "scarce Gothic moth" (*Phalæna typicoides*), was seen fluttering round the gauze covering of a French lamp. In a few minutes another made its appearance; and these were in a short time followed by a small number of stragglers. About eight o'clock heavy drops of rain began to fall, and finally a tremendous shower set in, accompanied with vivid lightning, and loud claps of thunder. The windows having been closed, a pattering noise was heard at them, and it was found to proceed from crowds of similar moths beating against the panes, or creeping up and down in a hurried and tumultuous manner. On opening the casement, a rush of these fluttering intruders took place, and collected thickly about the lamp. With not more than two or three exceptions, the mass consisted of these hitherto scarce moths. Soon after ten o'clock the assemblage diminished, and at length the insects retired altogether; and singularly enough from that hour up to the date of the communication, which was four years later, not a single specimen could be discovered. There can be therefore little doubt that this vast flight was performing an

act of itinerancy, and having been overtaken by the shower, was compelled to take refuge in the most convenient place they could find.

Mr. Bennett informs us that a vast congregation of moths takes place periodically in a certain district in Australia, forming apparently a mighty army of emigrants. Multitudes of these little insects, which are called by the name of "Bugong," congregate at stated times upon masses of granite on a mountain called from this circumstance Bugong Mountain. The months of November, December, and January are quite a season of festivity among the poor natives, who assemble from every quarter to collect these moths. They are stated also to form the principal food of those who inhabit to the south of the Snow mountains. In order to collect them, the natives make smothered fires under the rocks on which they congregate, and thus suffocating them with smoke collect them by bushels, and then bake them by placing them on heated ground. Thus they separate from them the down and wings, and the bodies are then pounded, and formed into cakes resembling lumps of fat, which are smoked and will thus keep as food for some time.

Sometimes a migration takes place of vast numbers of wasps. The blind traveller, Lieutenant Holman, relates in the second volume of his travels an interesting anecdote illustrative of this fact. "Eight miles from Grandie, the muleteers suddenly called out 'marambundas, marambundas,' which indicated the approach of a host of wasps. In a moment all the animals, whether loaded or otherwise, lay down on their backs, kicking most violently, while the blacks and all persons not already attacked, ran away in different directions, all being careful, by a wide sweep, to avoid the swarms of tormentors that came forward like a cloud. I never witnessed a panic so sudden and complete, and really believe that the bursting of a water-spout could hardly have produced more commotion. However, it must be confessed that the alarm was not without a good reason, for so severe is the torture inflicted by these pigmy assailants, that the bravest travellers are not ashamed to fly the instant they perceive the terrific host approaching, which is of no uncommon occurrence in the Campos."

The migrations of the locust tribes have long

been familiar to us. We have heard from childhood of the devastation caused by their migratory hordes. Scripture repeatedly alludes to them as the chastising instruments in the hand of the Almighty Maker and Ruler of the world and its nations. Egypt, Africa, Arabia, and even Europe, have trembled at their flight, and at various periods lamented over the desolations which marked their progress. Well may the Arabians call them "the army of the great God," for in numbers and power no army of men ever mustered together can compare with them. Their swarms have been seen of the breadth of three miles, and such was the length of the host that four hours were occupied in its passage over a single spot. A column of locusts five hundred miles long has been seen in India, and so compact that it completely hid the sun, producing, in the grand and solemn language of the divinely-inspired poet Joel, "a day of darkness and of gloominess, a day of clouds and thick darkness, as the morning spread upon the mountains." Well may Southey call these emigrant troops :

—“ a dark continuous cloud
Of congregated myriads numberless,
The rushing of whose wings was as the sound
Of a broad river headlong in its course.”

In a letter written by Captain Boys, to the secretary of the Entomological Society, he alludes to the intense mischief produced by locusts. “ The whole country has suffered severely from the ravages committed by locusts during the greater portion of last year (1844), and the latter end of 1843. The pink under-wing species were so numerous in the *terrai* at the foot of the Himalayas near Bennoriel, on the road to Almorah, that the branches of shrubs and trees on which they settled were completely hidden by them, and twigs a finger thick broken down by their weight alone. The ground was one brickdust red. I observed these wretches in flights extending for miles, so thick as absolutely to obscure the sun, and cause some difficulty to my palanquin-bearers in getting through them, as at every step they rose in swarms, striking and flying against the men’s faces in every direction. This was in the middle of October, 1843.”

Their armies have been seen at sea. In the

Massachusetts Register for 1840, an account is given of an encounter with one of these emigrant hordes, four hundred and fifty miles from the nearest land. The ship had been overtaken with a violent gale, and soon afterwards it was surrounded by large swarms of locusts, of a large size. In the afternoon of the next day the sky was completely black with them. They covered every part of the brig immediately, sails, rigging, and cabin. Two days afterwards, the weather being moderate, the ship sailed through innumerable millions of their dead bodies which lay scattered on the surface of the waters. We cannot doubt that this was the method employed by the Divine Creator in the annihilation of this fearful plague of insects.

How deep our cause for gratitude to Him who orders the movements, and appoints the course of these destructive migrations, that it has pleased Him, even while they have been permitted to desolate neighbouring countries, to spare our land from the infliction of this scourge. Locusts of the migratory species have been occasionally seen even in England, and the alarm has been given that a swarm of the destroyers

might be expected. But such has never yet been the case ; an ever-watchful and gracious Providence has put a fence round the shores of our island, and has not suffered the pest to come nigh our dwelling.

The migrations of other insects, of turnip-flies, of dragon-flies, of beetles, and even of bugs, have been commemorated by various writers. But the instances selected in this chapter are sufficient to set the fact before us in that degree of prominence, which its singularity and interest demand of the insect historian. And from these instances it will sufficiently appear, that although insects, like men, emigrate from place to place, desert one region and colonise another, sometimes being true emigrants—leaving the parent settlement without affecting the state of affairs in the latter ; and sometimes being only wanderers, the whole body migrating from one to another locality, yet that the motives which apparently influence the insect tribes, are only in a few instances strictly analogous to those which lead to, or even necessitate, human emigration.

From what has been detailed in this chapter on the subject of insect emigration, it appears that

the departure of a society, or of a congregated multitude of insects is not in every instance produced by the same cause or causes, and that occasionally the causes leading to the movement are involved in the deepest obscurity. The most common of all causes are those to which allusion has already been made, want of room and scarcity of provision. Bees, confined and cabined within a city whose extent is fixed and unalterable, have no alternative left to them on the increase of their numbers, but to throw off a swarm of emigrants, and thus relieve the plethora under which the community is labouring. Ants, on the contrary, have every facility for extending their city, should it so please them. They have but to set some of their labouring thousands to the task, and it would not fail of execution. But as if apprehensive that dangers of some kind or another would arise, if the community became too populous, they seek a wider dominion in a more favourable region. As if, however, to teach us how little we are really able to enter into the motives which actuate the insects, their emigrations appear frequently to be the result of caprice, or even of accident. Insect historians

have been also baffled in their attempts to explain the causes which lead to the emigration of the vast flocks of insects not commonly living in society. So little is at present known of the causes concerned in the production as it were suddenly of innumerable myriads of insects which is occasionally observed, the multitudes appearing rather as if they had been created on the instant, than as having had to pass through the various tedious stages of insect development, that it is almost vain to expect an explanation of their singular emigrations. Yet who can carefully consider the fact of the sudden and simultaneous departure of millions of beings from a country, which if permitted to remain, would deposit inconceivable numbers of eggs, to give birth in due time to destructive and voracious larvæ, without the inward conviction that such an event cannot be the result of accident, but forms a part of the wondrous scheme of Divine Providence. It appears in truth, that emigration is a means employed by the Creator in the removal and subsequent destruction of these creatures, the numbers and voracity of whose progeny might render them otherwise, as

they have often done, a terror and a scourge to mighty kingdoms. When these swarming emigrants proceed in their expedition, they become the prey of numerous enemies. Birds, the swift foes of the insect tribes, sweep off their numbers, and insect enemies prey at their ease upon them. The very elements appear leagued against them. Boisterous winds dash them to the ground, or drown them in the waters. Finally, man himself takes the field against the invaders, and in various ways causes the destruction of thousands. Nothing in short appears more plain than the inference, that in a large number of instances of the class to which these belong, emigration is a Divinely appointed means of riddance to a country from a dangerous though insignificant order of beings. A precisely parallel instance of emigration, and on an equally great scale, and apparently with a precisely similar object in view, is to be found in the animal world. The lemmings, a species of rat, at certain periods set out in emigrating armies, not less numerous than those of insects. They march in a direct line for the ocean, and, after swimming about in it for a little while, are all destroyed. So with

the swarms of butterflies, aphides, and other insects,—the prey of their enemies, the sport of the tempest, and destroyed of man; the vast host is dispersed, and ultimately so completely annihilated, that scarcely a single individual that once formed a member of its ranks can be discovered.





CHAPTER II.—THE CITY.

W. H. H. L. L.

CHAPTER II.

THE CITY.

What well appointed commonwealths—where each
 Adds to the stock of happiness for all !
 Wisdom's own bowers ! where professors teach
 Eloquent lessons in their vaulted hall—
 Galleries of art ; and schools of industry !
 Stores of rich fragrance ! orchestras of song !
 What marvellous seats of hidden alchemy !

THE foregoing account of the process by which
 the insect tribes diffuse themselves over their va-
 rious kingdoms, exhibits somewhat of the intel-
 ligence and activity displayed in the lives and
 habits of these minute creatures : but if we
 would get an insight into insect doings, calculated
 to fill us with speechless astonishment, they must
 be watched in their relations to one another, and
 to the community at large as fellow inhabitants
 of a common abode or city. Insects are now
 to be studied in their life as citizens, and the

subjects of some sort of government. And here it will be evident that insects at large are not included in these remarks. The social insects are truly a wonderful part of the creation of God, and the order and regularity of their government entitle them at all times, much more in a perturbed period, like our own, to the respect, if not even to the instruction of mankind.

In treating of insects in their capacity as citizens, the occupants of a common dwelling, or rather town, it is necessary to observe that however much the facts detailed wear the appearance of extravagance, or even of invention, they are strictly true : they are the result of the prolonged, repeated, and direct observations of men whose acquaintance with the little beings described has been that of a life-time. Although therefore they may appear almost incredible, they are as rigidly matters of fact and discovery as are those of any other science whatsoever. Insect-history is so full of wonders that can be well substantiated, that it can well afford to lose all extraneous ornament.

In the constitution of insect society, as in that

of human, it is important to remark that there are certain distinct classes into which the individuals comprising the community are divisible. There are differences of administration, of occupation, of character, and of quality or rank. The most perfect models from which our observations can be taken, are the societies of ants and of bees. Here we find that the insect-city is ruled upon the most strict principles of political economy, and, though after all it may be true that the terms of queens, of subjects, of constitutions, and of republics, are not to be taken according to their strict letter, and present but a poor and imperfect image of human forms of government, in the constitution of which the members have the advantage of reason and of the Holy Word of the King of kings, yet an analogy sufficiently close may be drawn between the humble insects and ourselves to warrant the restricted application of these terms to their societies.

Let us take a glance at the constitution of affairs among the inhabitants of an Insect City to be found in most country flower-gardens.*

* It is necessary to state that the history of the domestic Honey

In this realm, then, from time immemorial, society has been divided into three classes, each distinct from the other. Of these the chief person in the empire is the queen monarch, who occupies the throne, and is regarded with the profoundest veneration by all classes of her subjects. Next come the male citizens, commonly called drones, and next the labouring part of the community, otherwise known as neuters. These classes form the three essential members of society in this important kingdom. The queen, in conformity with her exalted station, is distinguished from the rest of her subjects by a more stately gait, by the shortness of her wings, and the greater length of her royal frame. Her colours also distinguish her from the vulgar crowd by their peculiar depth and brilliancy. A part of her person is of a brilliant black, and her hair is a rich copper colour! The male part of the population are large, burly fellows, which make a great noise in the world, but are little esteemed, and are at stated times massacred without mercy by the other inhabitants, as useless persons, and as

Bee is that selected in the text for the illustration of the constitution of Insect Society.

they do not carry weapons this is effected without difficulty by the other well-armed members of the community. The last class, by far the most numerous, is the labouring class. They are the smallest members of the society, and in addition to other characteristics, they may be known by the peculiar pockets, of which, like good housewives of old, they carry one on each side of the thighs. They are provided with a keen envenomed weapon, straight, hard, and glittering : which, upon undue provocation, these redoubtable labourers are rather fond of unsheathing and putting into use. In addition to these three prominent divisions of society, the historians of this kingdom have occasionally made mention of a fourth class, which they have denominated Captains. They are ornamented with a peculiar top-knot of a light colour, which may be likened to the military officers' plumes ; but it does not appear that they have any peculiar class of duties to fulfil : and very unlike *our* captains, they do not think it beneath their dignity to work, build, and perform every description of labour that is performed by the labouring classes generally. A celebrated his-

torian of these citizens, Francis Huber, informs us that at times he has noticed some of them whose complexion was dark or nearly black. Although these unfortunates appear to be in all respects as good members of the community as the rest, although, like others, they toil in the field and flower-garden, and on the heathery hill, and although no difference in the world between them and the labouring classes is to be detected, excepting in the matter of their dusky hue, yet the black citizens are persecuted and oppressed by the others, and are driven ignominiously out of the kingdom. In vain the plea, "Am I not a sister,"—in vain their willingness to share in all the duties of subjects,—they are expelled to seek in the world without, the home which their inflexible parent country has denied them. Alas! the black part of the insect population are not the only beings who are persecuted because of their complexion.

Such is the constitution of society in this realm. Before, however, we enter upon the history of the social economy of this kingdom, it is right to advert to the various offices discharged by the

three classes of society—her majesty, the labourers, and the burly drones. The queen is the parent of her subjects; not in that metaphorical sense in which this expression is understood in its application to earthly monarchs. This queen is really and truly the mother of all the inhabitants of her kingdom. The labouring classes perform the whole drudgery of the kingdom, rear the young, collect and store the provision, and are the great architects and executers of all the buildings in Apia. The drones are a sad do-nothing set; they are the hangers-on of society, and though necessary to the existence of the race, they play a very inconspicuous part in the conduct of affairs. Living an indolent life of ease, revelling in sweets collected from flowers, and quaffing the dewdrop on the spray, they spend a short sunshiny life, and generally perish, as we have said, by the hands of their fellows.

Let us now look a little more narrowly into the affairs of this interesting kingdom. As in duty bound, let our first respects be paid at the royal court; and, as is unfortunately rather too much the case with earthly monarchs, since the

royal proceedings have been watched in the minutest particulars, we are able to furnish a very complete sketch of all that goes on within its precincts. For this we stand indebted to various famous reporters of the court-affairs, by name, Réaumur, Bevan, Huber, Kirby and Spence, and others. No place is so wonderful as the royal nursery.

In order to observe the events which present themselves to our notice here, it is necessary that we should consider the kingdom to have been by some accident deprived of its monarch. The lamentations ended, the workers set about the extraordinary task of making a new queen! For this purpose, they select one or more larvæ of those already snugly ensconced in waxen cradles. They determine its destiny, and while it sleeps the honour is thrust upon it of being heiress-presumptive to the throne. The workers cut away the walls of the bed-chambers of two other larvæ which they destroy, to make room for the royal infant. They then alter the direction of the royal cell from the longitudinal to the vertical position, lengthening it as the young

princess grows. She is also now fed with a highly delicate and pungent food, called royal jelly, and it is supplied to her so profusely as more than to satisfy all her requirements. The result of all this care lavished upon her in common with one or two other of her royal sisters, who are similarly treated, is to produce the most remarkable alteration in the nurslings. Had they been permitted to remain quietly in their cells, they would have become members of the labouring class. As it is, fostered by the food they receive, and mysteriously affected by the altered position and circumstances in which they are placed, they become endowed with all the remarkable characteristics which distinguish the royal family from the common people.

In more common circumstances, when the royal family are placed in suitable apartments from their birth, the same steps are not necessary, but the young princesses are, as in the former case, fed with the royal food, and tended with the most affectionate solicitude.

The inhabitants, deprived of their former monarch, in consequence of her having taken her de-

departure in company with a band of emigrants, look forward with great anxiety to the birth of the royal princess; and at this time the public mind in the city is agitated by the oft-repeated inquiry, "Is our sovereign born yet?" Until this auspicious event takes place, public affairs can scarcely be said to be established in exactly their regular order. All classes of her subjects are awaiting the moment when the joyful intelligence shall fly through the streets, and re-echo along the hexagonal habitations of the city, "The queen is born." All this time, however, a royal guard is placed at the door of the apartments of the slumbering princesses. The careful sentinels remove a portion of the door, through which they can observe the condition of the royal infant. The time at length comes, and out of the number of the royal bed-chambers which are thus guarded, it is evident, from the behaviour of the sentinels, that in one the princess is born. And now we might imagine the citizens all anxiety to behold their new-born queen, and to liberate her from her apartment. Quite the contrary. As if in order to give her time to gain

strength, she is not at once exposed to the vulgar gaze, but a little hole is made in her bed-chamber door, through which she is supplied with food. Her strength matured, the sentinels fall back, and the queen emerges in majesty, finely and delicately formed, and is instantly received with joy by her affectionate subjects.

But from the other royal cells, a plaintive note may be distinguished, which proceeds from the captive princesses there confined. The newborn sovereign answers back to the hoarse piping of the captive, in the shrill tones of bee language PEEP, PEEP. What may be the precise translation of these words it is difficult to say. But it is painfully evident that they portend no good to the unhappy captive. For the young queen rushes to the cell in which her rival is confined, and would instantly destroy her, were she not respectfully restrained, much against her royal will, by the guard which surrounds her. There is now the greatest ferment in the city possible. Public excitement reaches its highest pitch, and the kingdom almost becomes too hot for its inhabitants — (104° Fahren-

heit). Another princess is born, and flies for refuge to a crowd of excited citizens, who however have little compassion upon her. As the law of primogeniture is inflexible in the city, the first born is the natural heiress to the throne, and all others are necessarily usurpers, and must be treated as dangerous to the commonwealth. The elder princess, therefore, furiously attacks the younger, and a deadly conflict may now be witnessed in the streets of the city, the inhabitants looking on with approbation, or even inflaming the royal combatants against each other. Their glittering poniards are drawn, they rush upon each other, there is a deadly struggle, wing to wing, limb to limb! At length the elder princess, seizing a favourable opportunity, plunges her weapon deep into the panting body of the younger,—she quivers, the deadly venom steals through her frame, her limbs relax their hold, her wings are spread out in the spasm of approaching dissolution, and falling backwards, she breathes her last, leaving the victorious queen, surrounded by the unpitying lookers on, the undisputed ruler over the realms.

This deed of violence accomplished, the queen destroys her remaining rivals, and is now the acknowledged “monarch of all she surveys.” She is treated, too, with royal honours. Some historians narrate that, in her task of depositing eggs, she is accompanied by a royal body-guard, but this does not appear to be the case. It is, however, certain, that when it pleases her majesty to move among her subjects, they regard her with unbounded respect; and the true court etiquette, of never turning the back upon the sovereign, is observed with the utmost punctiliousness; for the citizens, whenever the Queen, Melissa* by name, comes near them, instantly turn round and keep their heads towards her. Wherever she moves along the streets of the city, they instantly clear the way, and form a circle around her, occasionally, during the royal progress, paying her those marks of homage which are customary in their kingdom.

A pleasant spectacle it surely is to behold the Queen thus proceeding along the streets of the city,†—her gait so measured, stately, and queen-

* In Greek—that is to say.

† See the Frontispiece to this Chapter.

like, her mien so right royal and majestic, and all her movements so characterized by the grace befitting her station, and all perceived and honoured by crowds of her loving subjects. It is a sight worth seeing, and as the realm not unfrequently lies within the narrow limits of a flower-garden, it is a sight which many may see,—if they will observe.

It is our pleasing duty, now, to advert to some of the proceedings of the commoner classes. Let us follow a band of emigrants to their new home, and we shall observe how cities are founded, and public works executed by this people. The labouring classes, or workers, are divided into two orders, to each of which a distinct office is assigned, and exactly fulfilled. The function of the first of these classes is the collection of the materials for the construction of the city;—that of the second is the more delicate and difficult task of its manipulation, and of its employment in the building. The sex of these industrious inhabitants is the female, but they are not destined to become parents, except when by accident the queen has been lost, and a larva, which would otherwise have

become a labourer, is selected to be made into a fertile mother and queen, in the manner described.

The citizens, being comfortably settled in their new quarters, immediately commence the foundation of their city. The collectors are despatched far and wide into the fields and forests for material, wherewith to give a sort of varnish to the walls of the wooden cavity in which they have established themselves. From the bursting buds of trees, they gather a tenacious gummy substance called *propolis*, which they apply to this and other purposes. This done, the walls must next be raised. The collectors, having laden themselves with the ambrosial food of the gardens they have visited, return to their home-quarters, and here, in a very odd manner, they hang themselves up in festoons for a whole day. At the close of this period, by a curious process of vital chemistry, little plates of wax are found formed in four pockets contained in the abdomen. The collector now proceeds to make these plates available to the work in hand, and going to the top of the cavity where the city walls are to be first founded, draws this

beautiful material from its pockets, and by a combined process of chewing, moulding, and mixing, forms out of it a little mass which is then fixed to the wall of the cavity. Similar steps are taken by a number of other collectors, and a mass of ductile, easily managed substance is now raised, which constitutes the foundation of the walls.

The true architects now engage upon the work. This they commence by excavating, in the foundation thus laid, a small cavity, which is by successive labour deepened so as to form the commencement of a chamber. Employing those curious organs of sense, the antennæ, to explore the whole of the work thus carried on, it is performed with an accuracy, neatness, and despatch, with which no human labour can endure comparison. Undirected by a single ray of light, or at best by a very dim and profitless glimmering through the open portal of the hollow where they have settled, their work bears the scrutiny of the keenest eyes, and even of assisted sight. The collectors continue bringing in fresh materials, elaborating wax, and thus keep the architects constantly supplied with material for their task. The

walls of the chambers are now raised, and they assume the peculiar hexagonal character by which they are known. The work rapidly proceeds. House is joined on to house, all constructed with the same skill and accuracy, as the earliest ones. In a day or two, the city has grown to a considerable extent, and bids fair to become one of the most prosperous of its kind.

The houses vary in form and in size. The royal nurseries are the largest, and may be easily recognised by their being vertically, instead of horizontally, placed. The builders labour with scarcely an intermission, and since nature would be exhausted by this excessive toil, were they not well fed during its continuance, a portion of this class of the community is charged with the office of supplying them with food, which is very faithfully and freely executed, there being an infinite degree of mutual respect and affection exhibited by the inhabitants in their behaviour toward each other. The crevices are all securely stopped with the resinous gum to which we have before alluded. It is also employed to secure the stability of the outworks

of the city, and hardening into a brownish substance insoluble in water, it serves a variety of useful ends in the building operations of this community.

Some of the dwellings constructed with so much care and perseverance, and with the most admirable economy of material and space, are devoted to one purpose, some to another. In these, the infant male population are nourished and brought up,—to return but a poor equivalent, in the way of labour and usefulness, for the attention and affectionate care exercised towards them in their hours of infancy. In these, the royal princesses are developed in all their fair proportions; and in a third class, the humble dwellings of the city, are born the most laborious, useful, and probably the most happy members of the society—the working citizens. In others, again, are contained rich stores of provision. Of these, some are sealed up, and are not allowed to be opened excepting during the existence of famine, or during a “bad state of the crops,”—that is, of such crops as are of importance to our insect tribe—the flowers and their pollen. But others are the larders of the city, and are liberally

kept open for the supply of the daily necessities of such of its inhabitants as are at home, and in need.

The general aspect of this city is highly pleasing. Its buildings are all constructed on the most just principles of mathematical science. Its streets are beautiful, regular in their arrangement, and sufficiently wide to permit two of the inhabitants to walk abreast, there begin no vehicles known within its walls. To the lovers of architectural fancies, it might appear that the general character of the edifices was a little *too* regular, and its streets in this respect widely differ from our own, in which no house is like its neighbour. But the lover of uniformity, of neatness, and skilfulness of arrangement has little to desire in their contemplation, only that the parallel between human and insect habitations in these respects were a little closer.

Above all it is necessary to notice that the most extreme attention is paid by the citizens to sanitary measures. Their system of warming and ventilation is unique and complete of its kind. If the reader will pursue the following direc-

tions, he will have a practical experience of the perfect efficiency of the plan adopted by a citizen, when anxious to become warm or to communicate warmth. Let him place himself in a suitable position, in a closed room, in temperate weather, and begin to breathe by a voluntary effort, more quickly than natural. Let the forced respirations be continued and increased in depth and frequency, and presently the temperature of the experimenter's body will begin to rise, and, if not exhausted by his efforts, he will be able to put himself into a genial glow from head to foot. The citizen does exactly this. There is a period in the life-time of the young, when an elevated temperature is necessary to its development. As there are no sources of artificial heat in the city, no fuel, and no stoves, or fireplaces, some other resource must be adopted. The affectionate and careful being who is watching over her young charge, places herself near it and begins to breathe exactly in the manner described. Respiration in all creatures being in fact a sort of combustion of low intensity, heat is thus abundantly produced, and the tender frame of the young, as well as that

of her guardian and nurse, soon glows with invigorating warmth. The general temperature of the whole city is maintained, says Mr. Newport, during the period when the citizens are active, solely by their respirations, and the heat thus created rises at times to a very high degree.

The ventilation of the city is likewise thoroughly accomplished in a very simple and ingenious manner, for an account of which we are indebted to the indefatigable Huber. The labourers are the class to whom is also entrusted this important task. Ignorant of machinery, instructed only in the perfect use of those beautiful appendages (the wings) with which an all-wise God has endowed them, and acting in the most complete concord, and as if animated by one mind, and under the direction of one chief, they station themselves in gangs near the entrance of the city, and then by fanning at an intensely rapid rate, they produce such a current of air as to preserve the entire atmosphere of the city in the most pure and healthy condition. When one set is exhausted, its place is occupied by a fresh set. Their labours are continued

without intermission in warm weather, day and night.

In other respects also these citizens set a notable example to the inhabitants of greater cities than their own. They are extremely neat in all their domestic arrangements. No excrementitious matter is allowed to pollute the streets of the city, their avenues are all kept scrupulously clean, and dirt of all kinds is swept out of the town. The dwellings, so soon as emptied by the development and completion of the young, are rigorously cleaned; every particle of untouched food, or of excrement, is swept out; the entrance, damaged by the escape of the former inhabitants, is repaired, and neatness and order are thus rapidly restored to it.

Beyond what may be gathered from the preceding observations, we can furnish little account of the civil government of this community. The queen herself, though respected, cannot be said to be obeyed. She has therefore no Privy Council, nor Ministers of State. Neither does there appear to be any centralization of the governing power. Yet the concord of the actions of the citizens, their division of labour, their strict

discipline, and admirable social arrangements, are as complete and regular as if all were defined by a Statute-book, and enforced by numerous civil dignitaries and officials. An intruder queen is imprisoned and hemmed in by a body of police until she dies for her treason. Again, as we have before hinted, at certain periods there is a massacre of the whole population of the Drones, who are felt to have become only an incumbrance to the community, and the devourers of the spoil gathered by the labours of others.

Sometimes our industrious citizens, are attacked by a formidable enemy in the person of the death's-head hawk-moth. This creature gorges itself with honey, and in time greatly impoverishes a hive. To resist the entrance of this intruder, the bees have recourse to a remarkable expedient. They proceed to fortify the entrance to their city in the most scientific manner. Their fortifications are remarkably ingenious. Sometimes they consist simply of a wall thrown up inside the gateway, perforated with holes just sufficient to admit the workers at its upper part. Sometimes several bulwarks

behind each other are formed, so as to resemble the bastions of a fortified town. Sometimes a series of intersecting arcades are formed, which permit free egress and ingress to the bees, but refuse admittance to their bulky foe. These fortifications are massive, and their substance solid and compact. In addition to these fortifications, the entrance to the hive is always guarded by sentinels. By night, when the moon is up, when the rest of the hive is asleep, when nocturnal insects are roaming over hill and dale, the faithful beesentry keeps watch, and patrols before the gateway of the hive, the antennæ stretched out straight before its body, and the insect on the alert to catch the slightest sound.

All these and various other features of the social economy of these wonderful citizens might lead us to, and even seem to warrant, the belief that a regular government and laws were publicly recognised by the members of the society. That is, however, more than can justly be said: for though such are the results, we shall look in vain for an explanation of them in any ideal central governing power, or body amongst themselves.

Perhaps one of the most immense cities of insects on record is one of which the "Texas Telegraph" paper gives the following account:—

"In a cavern on the right bank of the Colorado, about seven miles from Austin, there is an immense hive of wild bees. On a warm day, a dark stream of bees may be constantly seen winding out from the cavern like a long dark wreath of smoke. The stream often appears one or two feet in diameter near the cliff, and gradually spreads out like a fan, growing thinner and thinner at a distance from the cavern until it disappears. The number of bees in this cavern must be incalculably great, probably greater than the number in a thousand or ten thousand ordinary hives. The oldest settlers say that the hive was there when they first arrived in the country; and it is quite probable that it existed in the same state many years previous to the settlement of this country. It was estimated that there are many tons of honey and wax in this immense hive; and if its contents could be extracted readily, they would doubtless be found far more valuable than those of any silver or gold mine

that adventurers have been seeking for years in that section."

In our own country wasps are known as the inhabitants of cities of *papier maché*, made with exquisite delicacy and skill; but their habits and economy are not so interesting, as the occupants of a common habitation, as those of the store-gathering bees. In the British Museum, however, there is a wasp-city, found suspended to the branches of a tree on the banks of a river in South America, which actually contains a store of wild honey. The apertures for egress and ingress to this wasp-city are constructed with admirable ingenuity in order to carry off the rain, which is conveyed away by a pent-like projection over the doorways. The nest is constructed of dried rushes, underwood, and dried excrement of the tapir. The jaguar is the most terrible foe to these wasp-cities. He springs upon their well-stored nest, dashes it to the ground, and then shields himself from the enraged citizens under the dense foliage below. The wasps migrate elsewhere, and the jaguar, when all are gone, comes forth to feed upon the honeyed treasures of their ruined city. The scattered frag-

ments of wasps' nests thus destroyed by these animals are frequently met with in the woods.

Deep in an open space, in the midst of a well-grown forest, where the foot of man has not trodden, and where insects, birds, and beasts, are the only animated inhabitants, lies another city.* It is a city of a conical shape, so far as the portion of it which is not subterranean is concerned, and somewhat resembles the dome of a haystack, being roofed over with a collection of sticks, straws, leaves, and various little odds and ends of matters. These assist to protect the city over which they lie from rain and other casualties, and are also useful in forming a nonconducting material, which preserves the inhabitants of the city from the effects of severe cold. To get a glimpse of the interior of this city, we must resort to the expedient adopted by the fabulous Asmodeus, and we must gently lift the conical roof up. Within we shall find the most beautiful order and arrangement reigning over all. Halls, vaulted chambers, and pillared galleries, present themselves to the eye in every direction. There

* In this illustration the history of the wood-ants has been selected.

are spacious buildings, the walls constructed of well-tempered soil, with which, on the same principle as our bricklayers intermingle hair with their mortar, with a view to its better cohesion, fragments of straw, &c., are worked up, and provided with various adits and avenues communicating with different parts of the city, and with the open air outside. In the centre of the city, especially, the visitor will observe a spacious town-hall. To this, the various streets conduct the inhabitants, and here they commonly reside in great harmony, for the citizens love society, and prefer the companionship of their fellow-citizens, to the retirement of private life. The architecture of this city is not marked by the exquisite regularity of the former city; the chambers are rough and rugged, and are less finished than those: and although a certain general character pertains to the erections and excavations, for the city is a combination of both, yet to the eye of an inhabitant of the other city, and to our own, they want that regularity and neatness inseparable from the truly beautiful, even in insect architecture.

The population, equally with the others, is

divided into a royal personage, males and the labouring class, workers or neuters. The queen, by name *Rufa*,* enjoys the dignities of her position almost to a greater extent than queen *Melissa*. Wherever she appears she is treated with infinite respect and affection. It is even said that she has a body-guard of Amazonian warriors; and it is certain, that, in the spacious halls of the city, her presence communicates gladness to every inhabitant of the city having the privilege of approaching her majesty. Many a pleasant scene may be witnessed in the streets and squares of this city. When she takes her royal walks therein, attendants press round her, make presents of viands to her, brush every speck of dirt from her train, and such is their joy, that, it is even said, the citizens dance around in playful merriment, as she condescends to present herself to their notice.

And truly queen *Rufa* is an estimable princess. Her disposition strongly contrasts with the vindictive, jealous, and excitable queen *Melissa*. She is never seen, like the latter, in a sulky fit, nor attempting to destroy her sister princesses,

* The species of ant described is in Latin, "*Formica Rufa*."

in a spasm of furious jealousy. On the contrary, sometimes two, sometimes even three queens reign together in harmony. Her character is beautifully shown in the fact, that at the very foundation of the city, her first act was to strip herself voluntarily of her wings, so rendering it impossible for her ever to forsake her subjects, or wander from her home. In her progress from street to street, her kind attendants will sometimes lead her gently along, at others will insist upon the pleasure of carrying her over difficult and rough places. She, with her usual amiability of spirit, graciously receives and acknowledges these little acts of affection, and endeavours to give as little inconvenience as possible to her loyal bearers. Little wonder then, that queen Rufa is beloved, honoured, and affectionately received by her subjects, who, even after her death, tenderly wait upon the lifeless corpse, and, with an undiminished affection, caress and tend it as in the days when she moved in the streets of the city, the joy and pride of its inhabitants.

The life of the male citizens is short, and their end is commonly sudden. They therefore play

but a minor part in the conduct of affairs. The labouring class, or workers, are highly bustling and important personages in this city. Though they are females, yet upon them devolves all the labour, and, strange to add, all the military operations of the states. They plan, they build, they excavate, they fortify, they take care of the young, they collect, and they distribute the provisions—in a word, they do all the multifarious work required to be done in their city. It would occupy a volume, nay, it has already occupied volumes, to narrate the whole proceedings of the city. We can, in this place, do little more than simply indicate the functions discharged by the highly useful and important members of this insect community—the labouring citizens.

The duties of the workers commence with the dawn of day. Soon as the early sunbeam lights upon the summit of the city, its inhabitants, some of whom have been “watching for the morning,” are all in a bustle. The infant population must be taken out—thus early, for an airing, and then, in a quarter of an hour, must go back to the nursery, for fear of a sun-stroke. These precious little infants are a sad plague to their

patient attendants. They require very frequent feeding, and as they are like all infants, perfectly helpless beings, the poor nurses have enough to do to supply the mouths of some eight or nine thousand nurslings. They also must be kept very clean, and are frequently cleaned from head to foot. Notwithstanding all this labour and care, the nurses love their little charges with an affection not surpassed by any parent, although, strange to say, they are not their own, but are every one the offspring of good queen Rufa. In addition to these duties, the labourer has to provide for her own sustenance. She has also to carry the eggs, larvæ, and pupæ, backwards and forwards to various parts of the city; her movements, in this respect, being as much directed by the state of the weather as are our own. Besides all this, this patient and indefatigable labourer has to attend to the repair, and reconstruction of the city, to provide fresh accommodation for its increasing population, and to fortify it in such a way as to render it accessible with difficulty by any enemy. As evening closes in, the approaches to the city are all barricaded — huge masses of wood (twigs)

are thrown across the various entrances, which are also contracted by masses of such other materials as are nearest to hand. The whole population then secure in its dome-covered city, retires to rest for the night. A sentinel or two commonly keep guard outside. And here let us bid this wondrous city, with its sleeping thousands—good night.

Let us here drop the guise under which we have hidden the humble insects — bees and ants. What is the conclusion at which we are compelled to arrive on a review of their habits, and of the marvels of their government? None other than this: the laws which regulate them are written within them, by the finger of that great and adorable Being, who chooses to make the most despised creatures, the living epistles of His wisdom, goodness, and power, that, being known and read of all men, they may glorify Him who thus makes weakness strong, and insignificance the very exhibition of His glorious creative attributes. Their proceedings are explicable in no other way. Let us, therefore, as we behold these insect commonwealths united in their works, and admirably organised in their social relationship,

give to Him, whose right it is, the praise and glory, which, in their creation, at His hands, these insects, and all His works, were designed to show forth.

It is interesting to turn from those beautiful instances of insect order, and to notice, even though in a less perfect degree, the management of the cities as we shall continue to call them, or in other words of the common abodes of other insects besides the bees and ants. The latter insects, it will have been remarked, occupy a very unimportant part in the affairs of the city or kingdom during their infancy. They are deposited in appropriate cradles. There they pass through all their changes, as *larvæ*, then as *pupæ*, and it is only when they emerge as perfect beings, or in the full-developed *imago* state, that they take a prominent part in the business of the commonwealth. Then, instantly that they are born, they assume their duties, and, as it is said by some, before the day of their birth has closed, before the sun which rose and saw them still slumbering in the pupa-case, has gone down into his gilded couch again, they have tried their young powers over the field and hill-side, and have returned,

laden with spoil, which they deliver up to the hungry architects of the walls. The insects to which we are now about to refer, on the contrary, exist together as fellow-citizens only while in the larva state. Their social tie is simply a community of habitation, which each individual assists in the construction of, and their fellowship is merely the fellowship of fellow-lodgers and fellow-feeders.

These insects are among the commonest of entomological objects. Upon fruit-trees we very frequently see, disfiguring the smaller branches, thick and strong whitish webs. If one of them is taken down and examined, its interior will present at that time when it is full of its insect inhabitants a very pleasing spectacle. Pleasing, it should be said, however, only to those who have conquered their dislike to insects, and will take the pains to give them and their proceedings that share of their attention which they abundantly deserve; otherwise the sight of the interior of these beautiful structures will prove but little attractive. The web is full of caterpillars. Were we to observe them from what we may call the foundation of this silken city, we should find

the young insects proceeding to build their city in a very pretty and prudent manner. This larva population numbers four hundred strong, but being, as soon as born, but in a feeble state, they do not attempt things beyond their strength, but satisfy themselves with simply erecting a little temporary tent previous to the construction of their permanent abode. This they effect by forming a sort of hammock out of the leaf of the tree on which the careful parent has deposited them in the egg condition. This is roofed in with silk, and under one or more of these the caterpillars wisely recline, patiently waiting until their strength shall have been sufficiently recruited to undertake greater things than these. The work now commences in earnest. The industrious workmen, forgetting for a time their devouring propensities, and only seeking to construct a suitable protection for their tender frames, spin a thick layer of silk around the bottom of two or three twigs, which constitute the tent-poles. The limits of their dwelling being thus defined, they proceed to carry on their labours until they have entirely enclosed a certain space with a silken roof, and walls, and

floor; their city built out of this slight but elegant material, has no regular form, but partakes of an angular character, determined by the position of the twigs upon which it is erected. Its interior is not more regular than its exterior; but is divided into certain irregular apartments, each having a suitable entrance to it left. Here—like those wild inhabitants of Sarawak, about whom Sir James Brooke has told so much that is at once painful and interesting, who construct common abodes, which are supported upon poles at a great elevation from the ground—they retire to rest during the hours of darkness. A shower of rain will likewise bring them home, and hence on sunshiny days, they proceed to feast upon the green and pleasant food with which their city is profusely surrounded. Against winter they prudently prepare by thickening their city walls, and here, shutting themselves up securely, abide the severities of frost, the inclemencies of the skies, and, sleeping, await the coming of spring to resume their feasting, and to pass through their final changes, until they rise triumphantly into the air a new and winged form of joyful existence.

The sociality of these insects ends here. When full grown they bid each other farewell, and retire to some secret spot to undergo their change from the larva to the pupa, and from the pupa to the imago. It is very rare to find insects living together in all their preparatory stages. For awhile the inhabitants of one community, the occupants of one abode, at which they have toiled in company, they soon lose their consideration for each other, and part to meet no more, or to meet, it may be, only to fight and jostle one another in this contentious world. But the charming pages of Réaumur supply us with a delightful account of some silken citizens which spend the whole of these preparatory states in company.

The insects which do so are called by Réaumur the "*processionary caterpillars*," for a reason which will immediately appear. They are the larvæ of a kind of moth (*Lasiocampa processionea*). These insects, in Réaumur's words, while in their preparatory states, "feed together, spin together, rest together, not only during their existence in the larva form, but also even in the pupa state," separating only when they become

winged beings. While the inhabitants of this insect community are young they have no fixed establishment, but encamp on various parts of the oak trees in which they are found. They construct little temporary tents, which they abandon when they moult, and then form others. But when they are two-thirds grown they set about the construction of a permanent dwelling, which they will not abandon until they leave it finally. This silken city they form in company, and apparently chiefly carry on their labours during the night. By their patient toils they rear its delicate walls, causing them to project from the trunk of the tree on which they live. At a distance, it looks so like a warty excrescence, or a bunch of lichens, which it closely resembles in colour, that it is not easy to discover its real nature. It is of considerable size, being sometimes a foot and a half long, half a foot in breadth, and rising about four inches from the surface of the trunk. Its walls consist of several layers of dense silk applied one above another. At the upper part lies the city portal, near the trunk, and serving both for the ingress and egress of its industrious inhabitants. The

entire population varies from 600 to 800 individuals.

Let us take our stand at the foot of one of these wooden monarchs on which the silken city and its inhabitants are found. The day must be fine and warm, and the hour near sunset. If we carefully watch the city gate, we shall presently see a cautious head emerging from it, followed by the body of one of the inhabitants. The gate is scarcely large enough to permit two abreast to pass through; another immediately follows close upon the heels of the first, and another, and another, until a moving cord of insects is seen streaming up the rugged sides of the oak, every insect being so closely applied to that before it, as to leave no perceptible interval between their bodies. They are conducted by a chief, which occasionally halts for the more regular formation of the line of march. They are then seen again in movement, and with all the regularity of a regiment of soldiers. Their mode of marching is somewhat as follows.—The chief goes first with a regular measured tread, next follow in a line one or two, or more, which keep close behind the first; then come a few

two abreast, these are succeeded by some three abreast, these by some of four, five, or even six abreast or more, until the whole marauding army has defiled out of the city. When the chief halts, all instantly halt, when he marches, all immediately march too, and whatever be the line of his march, all follow it to the very last individual of the troops. It is a truly ludicrous spectacle to behold the leader thus exactly imitated by some five or six hundred followers, and to observe how rigidly every individual follows the line of march, however crooked or round about it may prove. Having reached at length the foraging ground,—generally some cluster of green leaves, the whole army encamps upon it and begins to feast, where we must leave our little citizens to satiate themselves until the morning's light warns them to return home, which they do with almost as much regularity as they set out.

Réaumur says that although the inhabitants of this insect republic observe such excellent military discipline, and invariably follow the chief at their head, yet, that in reality all the individuals of the community are of equal rank,

and the leadership is very probably a mere matter of accident.

Their time of change approaching, they additionally fortify their city, and assembling together within its silken sides, spin their cocoons in company, and bid, for a time, farewell to each other and the world without. The period of their release approaches, their last glorious change is accomplished; and, for ever quitting the beautiful structure which had so long protected them from the heat, rain, and cold, they separate to become the parents of families as numerous and as interesting in their habits as that of which themselves once formed a part.

The larvæ of several other species of moths form for a time similar associations, and construct similar habitations. Even the strict disciplinarians, about whom we have just been speaking, find their parallel in others of a different species. Bonnet has described the proceedings of the larvæ of a moth which march after each other, some in straight lines, others in curves of various inflection. As the bodies of these are of a fiery golden hue, they present a very agreeable sight moving in file over the delicate, white, and silvery webs

which they construct as a sort of soft causeway for their feet in the path between the city and the pasturage. The silken cities, after the final changes of their former inhabitants, become the favourite abodes of spiders, or of other insects which find their way into them.

Réaumur, in his pleasant way, speaking of the silken abodes of the processionary caterpillars after they have deserted them, says "Those who have felt so much interested in the account I have given of the nests of these insect republics as to be tempted incautiously to examine them, would have great cause for complaint were I not to caution them against carelessly meddling with these nests, particularly when they are filled with worms, or when the insects have quitted them altogether. The first time I noticed them, I happened to find a large number, rather too large a number. I separated many from the trees, and on examining them, covered my hand with their remnants." The result of this incaution was, that presently Réaumur felt severe stinging and pricking points in his hands, and between the fingers. His face, too, began to smart, and one of his eyes in a few hours became as much inflamed as if he

had been suffering under a violent catarrh, so much so, that he could scarcely open it. He quaintly says: "It is some consolation for every sufferer to be acquainted at least with the cause of his sufferings." He therefore endeavoured to detect the cause of these disagreeable effects, and found it to lie in the detached hairs of the silken citizens which were so hard and sharp as to penetrate the skin without difficulty. Several of Réaumur's friends experienced the same annoyance, and among them four ladies, who were merely walking near the naturalist and did not meddle with the objects of his curiosity, found their necks covered with inflamed patches of skin, which were very painful. We may be sure Réaumur meddled with these silken dwellings as little as possible afterwards. But wishing to draw one, he directed one of his attendants to smear his hands with oil, and detach a nest from the tree. The man, full of confidence in the remedy proposed by his master, little though the latter felt of hope as to its success, willingly executed the commission, and tore down several nests, disturbing them much more than there was the slightest occasion for:—"In less than a quarter of an hour," says

Réaumur, "both hands were completely covered with red and painful elevations of the skin, which did not disappear for three or four days subsequently. Réaumur imagines that these nests powdered, would form a good substitute for the ordinary blistering fly, and a more speedy one in operation.

Mr. Westwood,—to return to our more immediate topic, has described a singular moth-city found in the hollow interior of a false acacia, seventy or eighty years old, growing in a botanic garden. At about a foot high in the hollow trunk, a spongy soft mass was found, consisting of the remains of the pupæ of a species of moth, of their cocoons, and of several dead moths. After close examination, it turned out that these were the remains of a former city and its inhabitants, which had in fact stormed, entered, and taken possession of a nest constructed by the humble bee. But little trace was now left of the original occupants of the hollow trunk, for the invaders had so entirely destroyed their city and substituted their own constructions in its place, that it became difficult to discover any remaining monument of the industry of the unfortunate race

whose city had been sacked, and its inhabitants thrust out.

The same author has likewise given an interesting account of a butterfly-city found suspended from the branches of trees in Mexico. The walls of this city are much more dense than any which have yet been described; they resemble very thick parchment in texture, and in colour also. Yet, on examination with microscopic power, this beautiful material, which is as smooth as paper, is found to be in reality composed of fine silken lines interwoven in every direction. On cutting into the nest, a most singular spectacle presented itself, a number of the pupæ were seen hanging vertically in the interior of the nest. We might imagine an enemy had done this, and hung up the wretched captives, a mournful spectacle to the rest of this parchment city. At an earlier period, the cavity would have been found full of active larvæ, and of the green leaves of the spray on which it hung for their sustenance. At the bottom of this parchment town were appearances which strongly favoured the supposition of an enemy having found his way into it, and having put the inhabitants to the sword, for it was

thickly bestrewed with gory drops ! Mimic patches of blood red seemed to say the carnage in the grand conflict supposed must have been frightful ; and the sight of these, in addition to the mournful appearance represented of the hanging bodies of the inhabitants, seemed to tell only too plainly of the deeds of horror and of blood that must formerly have been enacted in this miserable city. But not so : no enemy had brought in his inflamed troops within these walls. These were the singular drops of red fluid noticed in the first part of this work, as commonly found after the change of the insect from the pupa to the imago state.

The degree of intelligence and the beautiful moral economy exhibited to us in the perfect societies of insects are greatly wanting in all other insect societies. The individual members of a community of caterpillars, know nothing of the forms of government which are so beautifully displayed in ants and bees, and other social tribes. They are true republicans. Acknowledging no superior among their numbers, obedient to a few rude and imperfect laws, their community presents but a poor picture of order and happiness,

so far as the happiness of social life is concerned. But if possessing no such admirable social organization as the others, yet their instinct is perfect of its kind and degree, and they dwell together peacefully and in harmony; and no such scenes of excitement as agitate the other communities, disturb the tranquil inhabitants of the cities of silk. Thus, although comparatively imperfectly endowed, they are in reality happy up to their capacities for enjoyment. If they have not the intelligence and ingenuity of the others, yet neither have they the distracting cares, the tumultuous passions, and the sanguinary propensities apparently excited by the force of circumstances in the breasts of the ants and bees. They unite in common work for the good of the republic, which they effect with accuracy and skill, and their abode presents us with a picture of unity and contentment on a simple fare, from which mankind might sometimes take a useful lesson.

No more perfect models of insect communities and of the regulation of insect cities are known than those of our humble friends the subjects of Queen Melissa, and Queen Rufa. We know

most about the proceedings of these, simply because they have been most closely observed of all families in the insect world. And what has not patient observation disclosed respecting them! What a wonderful order and government is not exhibited to us in these minute and despised creatures' history! Where shall we find a state the basis of whose public affairs has stood so firm, not for centuries, but for thousands of years? Empires, states, kingdoms, and all forms of government have in turn had their day, and many have crumbled into dust. But here, in a society of bees, is a perfect sample of a stable, unaltering monarchy; and we behold in the government an order of affairs coeval in its origin with the very introduction of these insects into our scheme of creation. From age to age matters have gone on in these states just as they did in the first hour when the Divine hand appointed them. Do we ask why? Then let us remember that human governments have been of man's creation, and their institutions partake of that perishing nature which characterizes the works of man. Upon what blood-cemented foundations have not empires and monarchies been raised? What vices and passions

have not combined to form the creation of the kingdoms of this world ! Was it to be expected that matters set in motion by an evil impulse, and regulated too frequently without the smallest reference to the Divine glory, could, or can long hold together ? The time of the existence of every purely human institution is measured, and must at length expire. But the insect world exhibits to us a durable condition of society, because constituted by God himself ; and during the lapse of ages to come, when it may be that human society will be again and again organized to be again broken and disrupted : the humble subjects of Melissa and Rufa, the occupants of the same soil, will still have to rejoice in the permanence of their order, and in the unaltered and unaltering character of their government and constitution.

Yet let us not forget that the character of insect governments and their laws of society, though perfect of their kind, by no means present us with a model for our own organization as a community. The poor insect, devoid of reason, plods on in the same course from year to year, from one generation to another. Its ingenui-

ties were as complete and exquisite thousands of years ago, as now. It makes no progress, and cannot avail itself of the experience of the past. Its pursuits, pleasures, and occupations were the same yesterday as they are to-day, and shall be until the to-morrows of the world are run out.



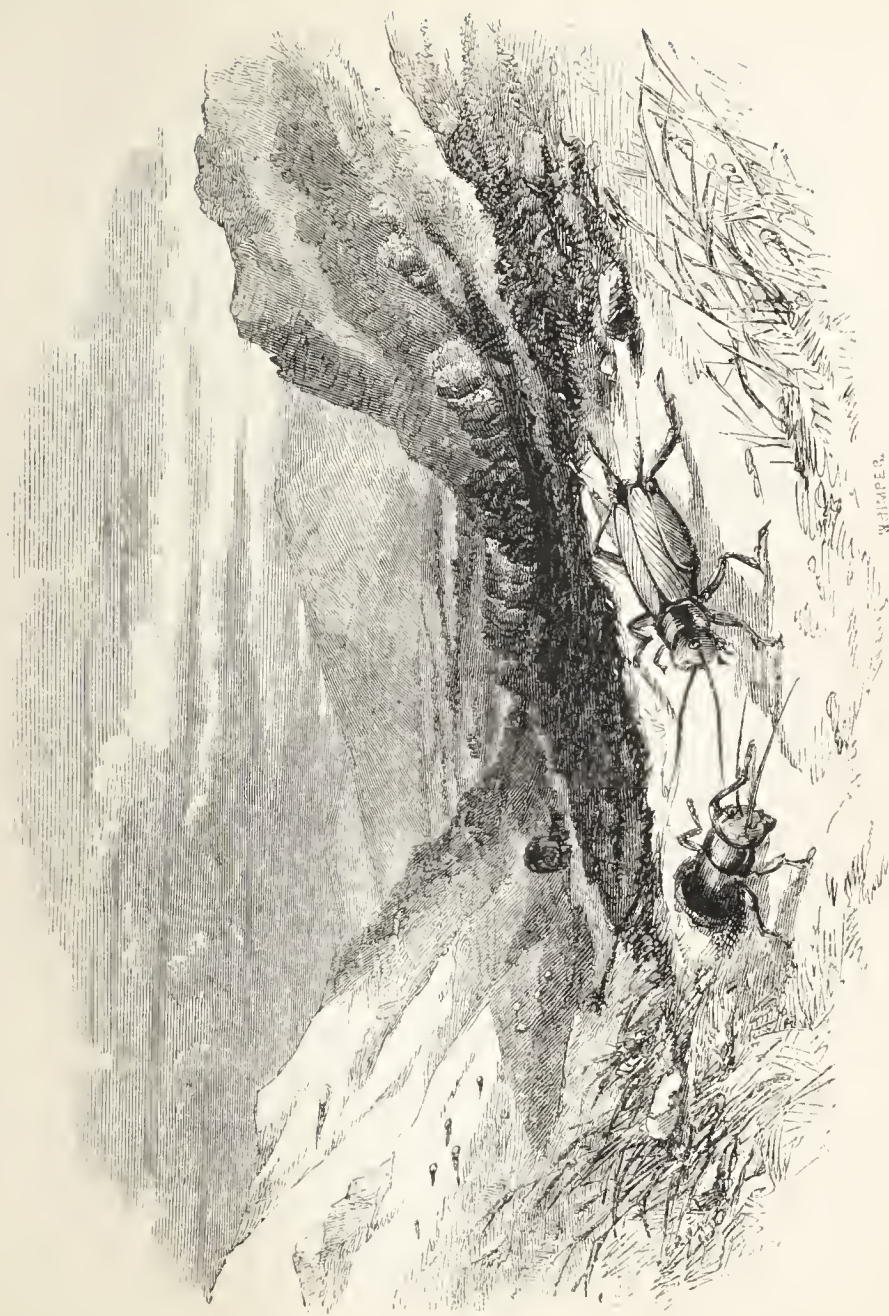
CHAPTER III.

THE CELL.

WE have read in old times,—and now and then even in our own day we hear of such an occurrence, that men disgusted with the world have repaired to the wilderness, and there in a rude abode of their own construction, nourished by such food as they can themselves either gather or produce, spend the rest of their days in solitude. Charming pictures have been drawn by the poets as to the happiness of these recluses. Milton has written,—

“ And may at last my weary age
Find out the peaceful hermitage,
The hairy gown and mossy cell,
Where I may sit and rightly spell,
Of every star that heaven doth shew,
And every herb that sips the dew.”

Yet there can be little doubt this happiness was purely imaginary. The poet Cowper knew better



W. H. H. P. 2.

CHAPTER III.—THE CELL.

the feelings of the human heart, and its instinctive longings after sociality, when he wrote the beautiful lines so familiar to us,—

“ I am out of humanity’s reach,
I must finish my journey alone,
Never hear the sweet music of speech—
I start at the sound of my own.

* * * * *

Society, friendship, and love,
Divinely bestowed upon man,
O ! had I the wings of a dove,
How soon would I taste you again.”

Man, unlike the insect-hermits into whose cells we propose to introduce the reader, is a social being, and was designed by God to dwell in society, and there consequently will he find his true duties, and his greatest happiness. There too, where God has graciously placed him, will present themselves to him those opportunities for assisting and making his fellows happy in the fullest sense of that term, which will enable him to serve God acceptably in his day and calling. The insect anchorets, on the contrary, were designed by their Creator to be solitary beings. Not endowed with social instincts, capable of performing every act necessary for their

own comfort and safety unassisted, and generally hostile rather than otherwise to their companion species, they are evidently well adapted to a private life. Were they to unite into a society, they would act as unnaturally and as injuriously to themselves and others, as does man when he voluntarily separates himself from his fellows, and, under mistaken impressions, buries himself in the obscure recesses of the wilderness, or in dens and caves of the earth. To take a single illustration in proof. Some ingenious speculators some time since conceived the idea of rearing spiders artificially, and of collecting the material of their webs for the purposes of manufacture, and as a sort of substitute for silk. But they had forgotten that the spider is in its nature a solitary insect from the moment when the young disperse from the nest. The result was, that furious conflicts ensued. The unwilling members of this community, fell upon each other with infuriate passions, and the whole speculation failed in consequence, although large sums of money had been expended in the undertaking, and although experimentally the material produced was of good quality, and suitable for the

end designed. Had the principle we have here insisted on been observed, these experiments would never have been undertaken, or at least they would have been entered upon with a provision for the separation of every individual insect, according to its natural habits.

Although we have in our present chapter only to deal with individuals, and to observe their solitary cells, Entomology presents us with a rich store of interesting facts upon even the unpromising subject—insect life in the cell. The following observations of a naturalist upon the cell of an Indian insect and its occupant,* present us with a pleasant account of the proceedings of the careful parent in providing a suitable cell for its larva.

“At Sangor Island, in the mouth of the Hooghly, I have frequently noticed the cells of insects, which are built of mud, by a species of *Eumenes*. The cells are generally placed under some projection, or in an angle, where they are very firmly fixed. They are of an oval shape, sometimes two or three together, placed side by side. Each cell is somewhat smaller than a

* Mr. W. W. Saunders, in Trans. Entom. Soc. Vol. I.

pigeon's egg, and before being closed up, is well stored with green caterpillars, which I have often amused myself by watching the Eumenes carry into the cells. When the cells are sufficiently stored, they are filled up so very neatly with mud, that it is difficult to discover the entrance. One of these nests was found in a keyhole, closing the aperture; another, in a bungalo at Ganga Sangor, was beautifully constructed inside an old flute, the insect having chosen one of the note-holes for the entrance to the nest. At Mud Point, Sangor, I observed several of these nests already built and sealed up; others the Eumenes were storing with caterpillars, while some were in progress of completion." Here securely enclosed, the insect feeds and fattens upon the store of food laid up for it, and passes from one stage of its development to the next, and from that to the last, before it quits the tenement of mud which for so large a portion of its life affords a shelter to it.

Our own fields and hedge-banks present us with a number of similar instances, to many of which allusion has already been made in the first part of this work. But the following sketch

of the doings of a Wasp, by Mr. Westwood, fully justifies its extraction into our pages. “ This insect commenced digging a burrow, but being disturbed by me, she quitted it and proceeded to commence a fresh one close to the former; when she had proceeded about the depth of her head, I observed that her jaws constituted her chief tools; with these she brought up particles of sand and bits of stone, creeping backwards to the mouth of the cell; when a little mound of sand had been accumulated, she set about brushing it further from the orifice by means of her fore legs, and it was droll to see the celerity with which these limbs were moved, and the shortness of time required to remove the sand, which was thrown with force beyond the body of the insect, the head of which was kept near to the opening of the burrow. In this manner she proceeded to a depth greater than the length of her own body, so that she was entirely hidden from view for several moments at a time, reappearing backwards as usual, with her mouth laden with sand and stones. During the periods whilst thus hidden in the burrow, I amused myself with pushing bits of stone larger than usual to the mouth of

the hole, in order to see her manœuvres in removing them; this she entirely effected by the assistance of her jaws, the legs not being employed in the task, even in cases where I placed pieces of stone much larger than her own body, which she moved in this manner. The largest of three bits of stone was even dragged to a short distance. During these operations a considerable buzzing noise was occasionally made. Notwithstanding these interruptions she proceeded in her work, and at length flew off. Thinking she had been frightened away, I left the spot, but shortly returning, I observed her at about a yard distance from her burrow, engaged in dragging along a large, smooth, green caterpillar, found, I think, upon the broom, and being that of one of the *Noctuidæ*; and I noticed that it was only by the assistance of her jaws and fore legs that she had secured her prey, the latter, which served her as arms, being clasped round the body of the caterpillar, and the four hind legs used in walking. When about half a yard distance from her burrows she set down her prey and flew off towards the nest to see that all was right, and returning again, seized the inactive caterpillar

as before, and ascended the bank in a more direct and easy way than she had previously gone. On arriving at the mouth of the cell, she again laid down her prey and crept into the hole, but instantly reappeared head foremost, seized the head of the caterpillar with her jaws, and dragged it down. These proceedings did not occupy more than a quarter of an hour."

It will be however more interesting to present examples of habitations constructed by the insect-tenants themselves. Of these there is an infinite variety. Perhaps one of the most singular, is the stony dwelling formed apparently by the insect, discovered and described by Colonel Sykes, under the title of the *Copris midas*. The following extract from the paper communicating the account of its discovery is taken from the Transactions of the Entomological Society of London:—

"At Poona, in the month of June, 1826, some of my palankeen-bearers were employed in loosening with pickaxes a friable and decomposing mica and greenstone, called *mohrum*, for the purpose of spreading it on my garden walks instead of gravel. While thus employed, they turned up with their pickaxes, from some depth

below the surface, four hard perfect balls. At first they considered them stone cannon shot, the Poona Cantonment and its immediate neighbourhood having been the site of two great battles: but observing that the pickaxe had injured one of the balls, and that it was hollow, they brought the whole to me. I immediately satisfied myself that they were of compact clay, well kneaded up with comminuted grass and very minute pebbles, forming, in fact, a well-digested mortar. They were two inches in diameter, and perfectly globular, and without hole, cicatrice, or fissure! The injured ball contained an amorphous animal mass, which I immediately pronounced to be the pupa of an unknown species of insect—at least unknown to me. On removing the pupa from the broken ball, the crust was found to consist of two coats: the interior surface was quite smooth, and formed of finer clays, much more elaborated than the external coat, which was somewhat rough. The diameter of the hollow within the ball was one inch and seven-tenths; the thickness, therefore, of the crust was three-twentieths of an inch. Another of these balls had its chamber one inch and six-tenths, and the crust was

six-tenths of an inch thick. To ascertain the insect proprietor of these curious domiciles, I placed two of the balls in a tin box, and continued for some months to watch them with attention: but my patience being wearied out, I abandoned further care of them, and put the box away. The third ball I gave to a lady, who, despairing of any change taking place, after many months' observation, broke it, but found the pupa inside quite fresh. Thirteen months had passed away, and I had forgotten the balls, when, on the night of the 19th of July, 1827, being in my study, I heard a low scratching sound. It was some time before my ear directed me to the tin box containing the balls, which stood upon a book-case. It was clear an insect was endeavouring to liberate itself. This object not being effected at one o'clock in the morning, I retired to rest. The scratching continued the whole of the 20th, and until I went to bed. Previously to retiring for the night, to facilitate the exit of the creature, I dropped water upon the ball to soften the very hard and compact crust. At sunrise on the morning of the 21st, I found the fine copris at liberty, an inch and a half long, and nine-tenths of an inch

wide, now exhibited to the Society. It must have been thirty-four hours at work; had been thirteen months in the pupa state, in my possession; and may have been thrice the time in the same state before it was found by my people. The second ball remained unaltered, nor were there any indications whatever of approaching developement in the tenant. It was allowed to remain in the tin box, and looked at after very short intervals of time. It was, however, the 4th of October, ere the second specimen of *copris*, now before the Society, worked its way out from its prison."

In what manner these curious insects enclosed themselves in such remarkable cells, appears quite a mystery. Not the least trace of any place at which the insect got into its stony chamber, was exhibited in its walls. In fact the appearance of these habitations was more that of some artificial substance, manipulated externally into shape, than what we should expect to be the work of an insect labouring from within. Not the least mysterious part of its history is its duration for so excessively prolonged a period, in the cell.

Réaumur says that the life of an insect which is always shut up in the interior of a fruit, can

scarcely present much interesting matter for consideration. But he is in error, for we shall find that the life of an insect thus secluded from the world, and withdrawn from observation of mankind, is an epitome of interesting particulars. Let us watch then its proceedings, and to do this we have need only to select an apple-tree infested with that woolly looking insect, commonly called American blight.* Toward eventide, as the sun begins to set, a beautiful little moth may be seen hovering with silver-spotted wings over a young apple on the laden branch. Resting a moment on the crown of one, it deposits an egg deep in the cluster of little leaves at the top. In process of time this becomes hatched, and gives birth to an active larva. This little fellow loses no time, but immediately sets to work, and gnaws downward into the fruit, soon becoming lost to the world, by burying itself in its sappy cells, which are more easily pierced at this than at any other spot. Eating his way through the fruit, he avoids the core, and so experiences no hindrance to his progress. In a fortnight's time he has got half way through the

* Letters of Rusticus, in Entom. Mag.

apple. The perforation made in entering has hitherto served him for the discharge of all excrementitious matters, but this becomes increasingly difficult in consequence of his size and the awkwardness of the direction of the passage. He therefore resolves to construct another entrance to his luxurious apartment, by which this end will become easily accomplished. To do so, he manifests a singular proof that his proceedings are guided by an instinct given from on high. As if aware that a hole made directly downwards would render the removal of the brown pellets of excrement quite easy, he now pierces directly downwards until he has driven his tunnel to the outside of the apple. This work accomplished, he retires back to his apartment in the centre of the fruit, and the little pellets are now rolled or pushed downwards, and so fall to the ground, leaving, however, generally a few grains sticking around the entrance.

And now this insect leads a life of ease and satiety. Its apartment, by the means last described, is rendered at once clean and well ventilated. Without a care as to the wants of the morrow, without a fear as to the accidents of the

present, he spends his days in alternate periods of eating and repose. No creature in this great world is more independent than he. While the wild beasts suffer hunger, and the tame ones suffer death, he lives in a world of his own, unharmed and amply provided for. Yet he is alone, and in the dark; he has no companion to share his pleasures or the burden of his excavating labours. For him the sun shines not, no cheering ray can penetrate his cell. None of Nature's music can reach him. He has enough, and more than enough—but he is a solitary prisoner, and has not a link to bind him with the sympathies of the world. Toward the close of his existence as a larva, he forsakes the juicy food in which he has so long revelled, and now with assiduous tooth applies himself to the destruction of the core of the fruit. Here for a few days he feasts in luxury.

But the time draws near when our insect must quit his cell. His last act of devouring has touched the seat of life in the fruit in which he dwells. The apple in a little while must fall: what then will become of our solitary insect hermit? Will he perish in the destruction which

is overhanging his dwelling, a fate which he seems to merit, since he has brought it about himself? Our insect is far too wise for this. Réaumur says, "I have cut open a hundred apples which had fallen to the ground, without discovering more than one or two of these insects in the cavity." As if warned of the approaching downfall of its tenement, the insect determines to do, as sailors tell us rats do in a sinking vessel, to make its way out as quickly as possible. This he effects by driving a round tunnel through its sides, through which he creeps and emerges into the open air. His first object then is to seek a hiding place, for the bustling tom-tits are on his track. He conceals himself in some crack in the bark of a tree for the night,—during which his escape is made. Here he remains for a day or two, as if to rest himself from the fatigues of his journey. Eating a little distance into the bark, he there spins a beautiful cocoon of snow-white silk, in which the change from larva to pupa takes place, and from pupa to imago. Bursting at length from this delicate case, the insect appears in the exquisite form of a delicate moth, the most beautiful of its tribe. At the

close of this narrative, the reader will probably agree with us, and admit that for once the accurate Réaumur was at fault.

The insects which construct moveable dwellings present us with a most interesting illustration of life in the cell. If a little sharp and patient observation is exercised in our daily walks, we shall not be long before we detect these minute but remarkable structures. They are to be found oftentimes in groups of three or four, or more, upon old walls covered with the scaly lichen so familiar to us, and so closely resembling the latter in their colour, and also so small in point of size, as readily to escape observation. What, however, we may ask, was too minute for the penetrating eyes of the last-named great entomologist? No recess was unexplored, no object connected, or likely to have a connexion with his favourite study, was passed by as unworthy notice; and for a period of twenty years this patient observer took a deep interest in watching the proceedings of the insects we are to describe, as they pitched their curious tents on the wall of the Tuileries at Paris. He turned the little hermits out of their cells in order to

watch how they would act, and the following is his account of their proceedings. Having robbed them of their houses, he put them in a box, together with some pieces of stone partially covered with lichens. The insects did not seem to care for the robbery much, but being very lively and active, presently set to work to construct new habitations. It so happened that Réaumur was prevented from observing the process throughout, but he saw several before they were quite completed. He noticed that the little tenant of this half-formed cell was very active in completing its house, and did so in the following manner. Seizing with its mandibles such little particles of the stone as appeared to it suitable for the object in view, it bound each particle into the wall with threads of silk, and so added particle to particle until it had completed its dwelling. An amusing sight it is to see these little hermits in their "mossy cells," for such is really the case. Réaumur distinctly states that small particles of moss as well as of stone, are employed in the construction of the cell. Now the head peeps out, looks this way and that way, and explores the rock for suitable masses for its architecture, then

is lost to sight in the darkness of its little abode. So diligently does the insect work, that in twenty-four hours the dwelling is completed. Its shape is exactly that of a gentleman's nightcap, in miniature! So minute are these little hermitages, that a lady's thimble would cover a dozen or so of them, without inconvenience to the caterpillar hermits within.

But the most ludicrous spectacle of all, only it must be watched by the aid of magnifying glasses, is to see the insects move about, dwelling and all. This great tower of stone—for so in comparison to the insect it appears—seems every moment as if it would topple over, and overwhelm its inhabitant in the ruins. It is never perpendicular, but leans more than the leaning tower of Pisa, and unlike it has not the security of a solid foundation. If upon the stone on which they dwell there exist inhabitants more minute than themselves, how strange, and even awful the appearance of one of these stone turrets moving across the rocky plain, and at the bottom the grim head and legs of a frightful giant revealing itself. But fortunately for such inhabitants of these stony plains, if such there be,

the en-towered monster is a very harmless creature, totally devoid of all bloodthirsty propensities, and quietly subsisting upon the minute lichens which paint the wall in sober hues, and communicate to it the sedate appearance of a green old age. At the apex of the towers a little hole is left, which serves for the discharge of excrementitious matters. Mr. Rennie narrates the following amusing anecdote of these insects:—

“One of the caterpillars which we deprived of its tent, attempted to save itself the trouble of building a new one, by endeavouring to un-house one of its neighbours. For this purpose, it got upon the outside of the inhabited tent, and sliding its head down to the entrance, tried to make its way into the interior. But the rightful owner did not choose to give up his premises so easily; and fixed his tent down so firmly upon the table where we had placed it, that the intruder was forced to abandon his attempt. The instant, however, that the other unmoored his tent and began to move about, the invader renewed his efforts to eject him, persevering in the struggle for several hours, but without a chance of success. At one time, we

imagined that he would have accomplished his felonious intentions; for he bound down the apex of the tent to the table with cables of silk. But he attempted his entrance at the wrong end. He ought to have tried the aperture in the apex, by enlarging which a little he would undoubtedly have made good his entrance; and as the inhabitant could not have turned upon him for want of room, the castle must have been surrendered. This experiment, however, was not tried, and there was no hope for him at the main entrance.”*

Allied to these little architects is the following insect, whose proceedings are described by Mr. Saunders:—

“Having frequently noticed cases of an oblong oval shape attached to the walls of rooms in the houses at Calcutta, and supposing them to be the abode of the larva of some insect, I opened some of them and enclosed others in a bottle. In some of the specimens examined, a chrysalis was found, in others a larva, and in others merely exuvia of a chrysalis. From those in the bottle there proceeded in time some small moths. The cases are

* “Insect Architecture,” pp. 230, 231.

generally attached to walls or partitions by silken threads of considerable tenacity, and are to be seen sometimes pendent from a beam or the ceiling. They are half an inch long, by one-fifth of an inch broad in the widest part, nearly flat, the longitudinal and transverse sections being lens-shaped, and margined along the sides. They are open at both ends, although attached to the walls at one end, the attachment being so managed as not to stop the entrance. The inside is lined with a silky substance, the outside covered with small grains, resembling sand. The larva, when full grown, is about three-tenths of an inch long, with the head and first three segments of the body dark brown, the remainder white. It has six legs, placed on the first three segments of the body, two on each segment. The chrysalis is of a pale yellow brown, and about a quarter of an inch in length. The moths were lost by an accident, and therefore cannot be minutely described. They approached in size the clothes-moth, and the upper surface of the wings were of a silvery brown. The larva has the power of turning within its abode, and if watched, when fixed to a wall, may often be seen protruding its head and

legs, sometimes at one end, sometimes at the other, as if in search of food. I have always found the cases tightly fixed, yet the larvæ have the power of locomotion. One of the larvæ, with its envelope, which I detached from a wall and placed upon a table, was very active in moving it about, by protruding the head and legs, and then laying hold of the table, when by a contraction of the body the case was moved forward, and as these jerks were rapidly repeated, the larva and its abode made considerable progress. When the progress of the larva was obstructed, it immediately withdrew into its home, and turning itself, began to retreat at the other end. Whilst on the table, it fixed its house several times, an operation so quickly performed as scarcely to be perceptible. I always found the cases nearly of the same size, whence we might be induced to suppose that at first the larvæ had the instinct to make an abode sufficiently large to suit themselves when fully grown. I could never determine the food of the larva, nor the manner in which it constructs its interesting habitation, particulars which I hope some other observer will supply."

Some insects, however, form moveable dwellings of a more singular and elegant kind out of vegetable substances. There is a little moth the larva of which constructs a dwelling out of the leaves of the astragalus, which has been compared to a petticoat adorned with deep furbelows. Perhaps a better comparison, would be a fool's or jester's cap without the bells. These little habitations are formed by the insect by cutting out portions of the leaves on which they pitch their tents; and then, with singular art, uniting them into one structure, with the addition of bands of silk and glutinous matter. Their appearance in the leaves of this tree, to which they appear to be confined, is very curious; and it might perplex the observer in no little degree, if he were unacquainted with the habits and manners of the insects which belong to this tribe,—the tribe of moths.

Réaumur gravely remarks, — “ Our clothing would look very ridiculous, and would be rather inconvenient, were it made of little sticks artfully put together; yet certain insects construct their coverings of minute portions of the blades of grass, which are to them as thick in proportion as rods

of wood to us." These habitations are perhaps the most singular of all. These little cells, which differ much in their appearance from each other, appear to be all constructed on the same plan. There is a central tube of silk, around which the fragments which form the roof of the dwelling, are placed. The insect, by means of its mandible, cuts a suitable portion out of leaves, and then fastens the piece on to the exterior of its dwelling. The aspect of some of these cells is very curious. Some resemble minute bundles of faggots, and others have an irregular odd appearance comparable to nothing else besides. The pieces are laid on with consummate skill, and by their strength communicate a great degree of solidity and resistance to the structure. The insect which constructs a dwelling thatched with the blades of grass arranges the cut pieces in an imbricated manner, like the slates of a roof, or in fact like the bundles of straw in a thatch. While other insects have to chop their pieces up into appropriate lengths and widths, constructing them out of leaves, &c., the insect which selects the blades of grass for this purpose, has merely to cut them transversely into appropriate lengths,

hence there is a beautiful regularity presented by its ingenious abode.

These little insects, when we compare their size with the material they employ, are heavy laden. No Roman soldier groaning under armour, shield, breastplate, helmet, sword, and spear, not even one of our own doughty knights, boxed up in plates of steel, a moving mass of iron, bore a load proportionably weightier than one of our insects. Yet they appear little encumbered by having to take up their homes and walk with them on their back. Strength equal to the task has been given them, and they wander hither and thither over the green leaf-plains and branch causeways on which they are found, without an apparent effort. Securely protected by the ingenious roof their own skill has erected over them, from the inclemencies of the weather, and from the dangerous observation of the enemies of insects, birds,—finding also ample food beneath their feet, and enjoying the full liberty of roaming about, the summer long, upon the waving branches of the forest—theirs is a happy life, and though a lonely one, yet doubtless even that has its alleviations.

Very different from these is the next example of life in the cell to which we propose to introduce the reader. We must no longer ramble in forest or field, but plunge into the recesses of the kitchen, and explore the natural history of the fire-place, even while a blazing fire roars within it. One would scarcely expect to find an insect living in comfort and happiness separated only by a brick from a fiery furnace. Such, however, is the position voluntarily selected by our familiar friend, the cricket, concerning whom a great poet has falsely written, that it is "all the blither for the drought!" "For the warmth," had been a more correct expression. During the day our cheerful insect retires within his cell, and conceals himself from view. Let us follow him, however, at night, and drive him to his retreat, and we shall see how comfortable a burrow he has made for himself. In the space between two bricks, where the mortar was unusually loose, he commenced his attacks, and in a little while, by diligence, patience, and perseverance, he excavated a cavity sufficiently large for his retreat. Here, ignorant of the luxuries of silken couches, he dozes the

day through, living in a mimic torrid zone. The night comes, and he steals forth to the depredations of which he is only too guilty. And now woe betide the scraps left in his way; to him scummings of pots, crumbs of bread, salt, or even wet woollen rags, form a savoury diet. The morning does not catch him abroad, for before the sun calls other beings into activity and life, he slinks away, and awaits the shades of night to recommence his spoils.

For an equally interesting illustration we may return again from the flaming regions into which we have penetrated, and seek the fields in that pleasant time when, in the words of Gilbert White of Selbourne, everything is "verdurous and joyous." Let us seek, too, in his pleasant pages an account of the insect, whose life in the cell we are about to describe. In the months of May, June, or July, and in some hot sandy district inclining to the afternoon's sun, and near some foot-path, we shall frequently hear the strong, sharp, and joyful song of our inhabitant of the cell. But we must approach with infinite caution. Only let him feel the least tremor of the earth and his music is instantly

stopped, while he himself has disappeared from view. The spade is too boisterous an instrument for our employment, if we would disinter this wary and cheerful musician from his cell. Gentle means are more successful, and we may either do as Pliny recommends us to do, insert a straw into its burrow, which will quickly bring out the inhabitant; or we may adopt the curious proceeding of children in France, who tie an ant to a string and introduce it as a sort of bait into the cell. Then we behold a strange creature truly! Its body black and shining, banded with yellow, and its head and lobster-claw-shaped jaws give it a somewhat awful appearance. This creature is the field-cricket, *Acheta campestris*. The cell in which it takes up its secure abode is often very deep, from six to twelve inches, and terminates under some overhanging rock,—by comparison, where its occupant resides in security all the winter long. The insect forms regular beaten tracks to its burrow, and woe betide the unlucky creature which falls in its way. It commonly sits at the mouth of its den waiting for way-farers,* and

* See Frontispiece to this Chapter.

such as come within its reach have small chance of escape, still less of rescue, when dragged to its subterranean dungeon-keep. While undoubtedly carnivorous in their propensities, they are also well content, when travellers are scarce and hunger presses, to eat indiscriminately of the herbs growing—a waving forest of green blades—around their prison-gate. Hard by the entrance they form a little platform, where they deposit all excrementitious matters. “Sitting in the entrance of their caverns, they chirp all night as well as all day, from the middle of the month of May to the middle of July; and in hot weather, when they are most vigorous, they make the hills echo; and in the stiller hours of darkness, may be heard to a considerable distance. In the beginning of the season their notes are more faint and inward; but become louder as the summer advances, and so die away again by degrees.”

To an inhabitant of a cell, whose person is yet more strange and wondrous than the last, we must now introduce the reader. To this creature we might almost apply with justice, the well-known words, “*Monstrum horrendum,*” &c. and were it only in reality half as terrible a

creature as it appears, it would rank among the most awe-inspiring of insects. But it is in reality a very harmless being, its food consisting, it is true, of insects, but it has also a taste for vegetables, and particularly affects a juicy potato. Yet it must be said, that, when excited by a fast of short duration, it has been known to fall furiously upon one of its own species, to fight with incredible obstinacy; and, alas! that it should be true, after destroying its opponent, to fall upon and devour the corpse with great avidity. This creature is the mole-cricket, *Gryllotalpa vulgaris*. Its strength is vast in proportion to its size. It is said to be able to lift a weight equal to two or three pounds.

Its cell, which is excavated by its remarkable fore feet, resembling hands, is generally dug in moist swampy grounds, and it particularly frequents the grounds near canals, thus presenting a striking contrast to its allies, which love the warmth and dryness of abode peculiar to the spots they select for their habitats. On the removal of the overlying soil a curious scene is presented to the spectator: the apartment in which our insect dwells, is a good-sized vaulted chamber,

carefully hollowed out in the earth; but curiously enough only approachable by a number of winding caverns and passages. Here, secure from invaders, it takes up its abode. Here its young are brought forth, educated, and sent out into the world. Here the parent, driven to its citadel by the enraged gardener, lamenting over destroyed beds of cabbages, and young legumes, the roots of which it cuts through, often meets with a violent death, being either crushed by a convulsion of the surrounding soil, or cleft in twain by the descent of a vast glittering instrument of iron, but having a handle of wood—in other words—a spade.

We are not able to point to any district in our own country in which so curious a cell-occupant exists, as the next to which we have to refer. This insect is a native of Australia, and has been called *Nycterobius*, from the circumstance of the larva only coming out of its recess at night to feed. It might, however, be also called the trap-door larva, from the peculiarity of its dwelling, to which we are about to advert. Being deposited on the bark of a tree, in the egg state, it is then developed and becomes a larva.

This little being immediately enters into the bark, and bores a cylindrical tunnel to the very centre of the stem, which it increases as it grows in bulk, and in which it retreats for protection and repose. But the larva has many enemies. Its excursions are never made without risk, and the empty dwellings have too often to deplore the loss of their occupants, which had only recently quitted them. The most formidable of these enemies is the extraordinary insect the "walking leaf." The larva that, misled by their extraordinary resemblance to a leaf, should inadvertently come in their way, is devoured without pity. To guard against these and other foes, which in open contest they are totally unable to withstand, the larva has recourse to a rare and beautiful contrivance, by which its cell is rendered impregnable by any enemy from without. This device is the construction of a peculiar hinged door to its cell, which readily permits the egress of the rightful tenant, but resists the entrance of an intruder. This door is formed of a strong moveable covering of web spun by the larva, and strengthened and solidified by interweaving pieces of leaves and other matters.

into its substance, until it assumes a somewhat convex shape. The door thus constructed must then be secured, and this is done during the process of its formation, by fastening the web securely only to the upper end of the entrance to the cell, the rest of the margin being left free and unattached. The door now swings easily forward on being pushed from the inside, but from the outside it can only be opened by the clever artificer that designed and hung it as a self-acting valve over the entrance of its cell. The weight of the trap-door, together with the inclination of the side of the tree on which it is always constructed, keeps it constantly closed, as effectually as if our insect had attached a door-spring to its ingenious contrivance.

The larva having thus provided for its security, proceeds to collect its food. After sunset it may be seen cautiously lifting up its cell-door and exploring the coast. Finding all clear it pushes the door gently forwards, and confident that it will of itself close behind, it sallies out over the woody wilderness in the midst of which it lives. Having, at length, fallen in with food, in the shape of young leaves, it cuts down as much

as it can carry and slowly retreats with its green burden back to its cell, being able to find its way even in the dark without difficulty. On reaching the self-acting door the larva insinuates its hinder end under the lower part of it, and thus gently lifts it up, dragging after it the leaf it has brought home, by creeping backwards into the cell. The burden is then deposited in safety in the cell and the industrious insect sets out on a second foraging expedition. Thus the larva proceeds during the whole night. But as soon as the early streaks of grey announce the sunrise, it is to be seen flying precipitately into its cell, and hastily lifting the door, is soon hidden from view in the dark and safe retreat it has constructed. To prevent the leaves slipping out of the cell, as they might do by their own weight, the insect frequently ties them down with silken cables to the walls of its cell. The insect, however, is too wise to leave the trap-door unsecured during the day. No sooner has it made good its retreat, and secured its provender, than it fastens the door by strong ropes of silk, which prevent entirely its being lifted by any enemy but the invincible enemy—man.

Sometimes the leaves are much too long to be contained within the cell, and then the insect permits the lower ends to hang out, communicating thereby a most amusing and singular appearance to the entrance of its cell, not unlike that of a straw loft, through the partially closed door of which bunches of straw are left dangling out. During the day the larva feeds upon the provision his nightly excursions have furnished him with, and drags up the out-dangling leaves piece by piece, until it has entirely devoured them. But that which is an admirable safeguard to these insects from the depredations of their insect foes, is the very means by which their retreat is marked out by their rational enemies of the human race. The aborigines of Australia prize these ingenious mechanics as a most delicious article of diet, they are consequently sought for with great assiduity; and the labour even of ascending high trees in the search for them is not considered of, if rewarded with the capture of a few of our poor inhabitants of the cell.

Mr. Lewin mentions another insect the larva of which constructs a cell also of a very ingenious

kind. Having bored its tunnel in the stem, it feeds on the bark and sappy wood directly about the entrance. But as this would expose it to the observation of its enemies, it manages to conceal its depredations by weaving fragments of wood and bark which it gnaws off, in a strong web. It thus constructs at once a fortification, and a disguise of considerable bulk and thickness round the stem, under which, like one of our military sappers and miners, in a winding cylindrical passage, the depredator constantly shelters its body while at work, alternately gnawing and weaving; but retiring into the central chamber to repose. After its days in the larva state are completed, it weaves a close door of tapestry over the entrance to its central chamber, to the dark and silent repose of which it now commits itself, while undergoing the final changes of its condition. Soon after this tapestry door is formed, the ingenious fortifications outside decay and fall off, their period of utility being now completed.

In the decayed stumps of the singular Australian grass-trees, a little insect is found, whose cell also deserves our attention. On cutting the stem of such trees as these insects have penetrated,

a singular spectacle presents itself. A number of minute cylindrical tubes or tunnels are seen running in various directions, all, however, distinct from each other. These tunnels are of considerable length, and are lined with hangings of the most delicately white silk. In these tubes a little insect dwells securely, feeding on the decaying wood, and undergoing its metamorphoses far from the reach of every enemy. It is the larva of a species of moth (*Tinea*). Curiously enough, when the pupa case is burst by the egress of the included insect, it is commonly left half emerging from the tunnel.

On removing the bark of fir-trees which have lain for some time in the timber-yard, we shall disclose another tenant of a cell whose proceedings have a serious claim upon our attention. This insect having been deposited by its careful parent, in a place of security between the bark and the wood, no sooner awoke to active life than it commenced its destructive attacks upon the timber which sheltered it. Boring its way at first in a serpentine direction, it fills the space which it leaves behind, with its excrement, resembling saw-dust, and so stops all ingress to

enemies from without. But when this creature has arrived at its full dimensions, it does not confine itself to one direction, but works in a kind of labyrinth, eating backwards and forwards, so as to give the wood under the bark a very irregular surface. Its paths are often of considerable width. Its attacks are not confined to the solid timber, but in its progress it eats away an equal portion of the bark. When the insect is about to assume the pupa state it bores obliquely down into the solid wood, to the depth sometimes of three inches, seldom, if ever, less than two. Its holes are nearly semi-cylindrical, expressing exactly the form of the insect. One would perhaps wonder how so small, and seemingly so weak an animal, could have strength to excavate so deep a mine; but when we see its maxillæ our wonder ceases. These are large, thick, and solid sections of a cone divided longitudinally, which in the act of mastication apply to each other the whole of their interior plane surface, so that they grind the food of the insect like a pair of millstones. At the place in the bark opposite this hole the perfect insect gnaws its way out of its prison when it makes its

appearance, retiring in fact by the same passage which the larva had excavated previous to its becoming a pupa.

The last occupant of a cell to which we shall ask the reader's notice is one whose size and power render its doings highly remarkable. This insect loves to dwell upon willows, poplars, and other trees, in which it forms its singular habitation. After being developed in the larva form it pierces into the wood and commences long and extensive galleries therein, the floor of which is covered with its excrement, consisting of the comminuted fragments of the wood through which it has bored. In thus perforating deep and extensive tracks through the tree, the insect spends its summer time. But on the approach of winter it prepares a chamber vaulted, rounded, and of considerable size. This chamber, however, with a true idea of English comfort, the insect takes care to hang all round with a thick warm coating of web, composed of silk of a strong kind interwoven with raspings of wood, and thus forming an admirable non-conducting lining to the walls of its apartment. Here, secure from cold and out of sight of all intruders, the insect coils itself

up and lays itself to its winter's repose, awaking on the arrival of summer, when it emerges from its place of hybernation and recommences its work of destruction. The muscular strength of this insect is amazing. Its muscles form a spectacle of ingenuity and intricacy of arrangement, commanding the admiration of every beholder. One of these insects was put by Mr. Rennie under a bell-glass, weighing half a pound, and weighted at the top with a thick volume, of not fewer than 1500 pages of strong paper; yet the insect succeeded in lifting this stupendous weight and escaped from its prison unharmed. This may lead us to view with less surprise its excavating feats in the trunks of old trees. Surely such a creature deserves the epithet of the Insect Hercules.

Perhaps one of the most curious facts presented to us in the whole range of entomology, is the habit of certain insects to wear artificial clothing of their own construction, strictly comparable to our own apparel. Long before man set his looms in motion, before the construction of the first rude machine for making a fabric, insects, Divinely taught, had appropriated to

their own use all the materials which we now employ for the formation of our apparel. Other creatures are furnished with various protections against the severities of the weather, dense coats of hair, feathers, scales, &c., but several tender little caterpillars are left with their soft bodies totally unprotected, and are thus exposed to all the dangers of starvation. But guided by skill given them from on high, they compensate for this want by forming very regular habiliments for themselves, in which they walk about, eat, and even sleep. It is true as Réaumur states, that the fashion of their clothes is not of the most *recherchée* kind, being commonly more like a sack than a coat, and in this respect not very dissimilar to some human garments, —but this arises from the configuration of the creature they are intended to protect, which, being commonly cylindrical, necessitates the adoption of a cylindrical figure for the garment likewise.

Human tailors commonly take the measure, and cut out the clothes without further communication with the person for whom they are intended. But our insects, on the contrary, form

the garments upon their own body, employing no other model or measure, and fitting the garment at the very time of its construction. Cutting down such of the material on which it is placed as is requisite for its foundation, it interweaves the fibres with some of its own silk, and so the fabric is commenced. Continuing these processes of spinning and interweaving, it forms a cylindrical garment in which its body is at length enclosed. It lengthens its case or garment by additions at each end, working first at one, then at the other end at intervals of a minute or so, and so quick occasionally is its manner of turning itself round, and presenting its head first at one end, and then at the other end of its sack, that one can scarcely believe that the insect has not in reality two heads.

This insect, which may be found on any old woollen garment that has been laid by for a time, is the larva of our too familiar enemy the clothes-moth, *Tinea pellionella*. In consequence of its employing the fibres of the material on which it rests, in the construction of its clothes, and as that may often be of different colours, the garment of our insect is likewise often parti-

coloured; and if it is shifted while in the process of constructing its garment from one coloured material to another, and that frequently, we can vary the insect's coat, until it has all the appearance of a harlequin's dress, "a thing," not of "shreds," but of "patches" infinite. But the insect grows, and therefore the suit which was amply large enough for it in its early years, is by no means large enough to accommodate its increasing bulk and portliness. As cleverly as, or perhaps more so than, any tailor, the insect resolves on increasing the size of its garment, which has become inconveniently tight. The remedy for this is simple; the insect slits its garment on the two opposite sides, making a cut as clean and smooth as if it had been effected by means of a pair of the sharpest scissors. It then fills up the intervals between the edges with pieces of the same material as constituted its original garment. Wisely considering—if we can say so much of an insect whose proceedings appear almost rational—that it would be left without a garment if it were to cut its original vesture through from one end to the other, it only slits it half-way down first, and then having neatly

pieced in the fissure it proceeds to cut the remaining half. If the insect while thus occupied is removed from a piece of cloth of a dark blue, to one of scarlet, or some other strongly contrasting colour, the size of the new pieces, and their shape, will be prettily represented by their being of that colour, while the rest of the suit is of blue. The insect actually, however, feeds upon the same material as furnishes it with fibres for the construction of its garment.

The larvæ of these insects clothe themselves with various other materials, and those of other tribes adopt a somewhat similar measure. This single instance may suffice for all, and we have this advantage in its selection, that the domestic entomology of every dwelling is sure to number among its ranks, the destructive larva of the clothes-moth. These coverings may be looked upon either as garments or as dwellings, for one and the same end is accomplished by them, namely, the concealment and protection of the body of the included insect.

Réaumur commences the fifth memoir in his third volume with the following just observation. “ One of those circumstances which most forcibly

strike the mind of travellers in foreign countries, is the variety of garments worn by the inhabitants of the regions through which he journeys. The aspect thus presented is truly singular, and may even be so to the eyes of the philosopher as well as to the ordinary observer. One cannot help wondering that man having in the formation of his raiment, only one end to serve, namely, to protect himself from the severities of the weather, or simply to provide himself with a suitable covering, should have employed so many different means of accomplishing his purpose. How different are the garments of civilized nations compared to those of savages. And how singularly do the fashions of the clothes differ even among civilized people, and among the various savage inhabitants of the globe. The change of *la mode*, and the return of the same fashions which we so constantly witness, teach us that the different forms of human garments have not always been chosen for their usefulness or even for their convenience." Réaumur might have instanced the hooped dresses of a bygone age, which were surely neither chosen for utility nor for comfort. "Our insects," he continues, "like the rest of the

world, fashion their garments after different models; but, unlike man, the fashion never changes in the same species; Nature (rather Nature's God) has instructed them all, and has taught to each the most convenient apparel for its preservation."

These remarks of this great entomologist, which, though primarily referring to the clothing of insects, have also a direct reference to the habitations they construct, are equally applicable to the variety of dwellings selected by the insect tribes. The variety of dwellings selected by insects for residence, chiefly while in the larva state, is very great, and the dwellings being always the same for the same tenant, we may always safely tell the nature of the insect from the cell it constructs. If we judge of the skill of the architect of one of our own habitations by the ingenuity with which he adapts his structure to the situation, or by the facility he exhibits in overcoming any difficulties of construction arising from the inappropriateness of the materials furnished to him, or from other and accidental causes, we may apply the same rule to the insects whose cells, so variously formed, and exhibiting

such ingenuities of adaptation to circumstances, have been the subject of our thoughts during the present chapter.

Gibbon tells us : “ The most perfect hermits are supposed to have passed many days without food, many nights without sleep, and many years without speaking, and glorious was the man (I abuse that name) who contrived any cell, or seat of a peculiar construction, which might expose him in the most inconvenient posture to the inclemency of the seasons.” How different the happy insect recluse from this ! He takes care to make his cell as comfortable as the skill and means which a gracious Creator has put in his way, admit of. By no means does he choose for his residence the most exposed and inclement spots. Quite the contrary ; our insect takes due care to defend himself from the weather by every possible contrivance, and never can he be accused of living “ contrary to common sense.” The cells lie deep hidden in the forests and fields. Hunting there oftentimes shall we find the insect recluse has chosen for his abode just such a scene as Spenser has painted in the following lines :

“ A little lowly hermitage it was,
Down in a dale, hard by the forest’s side,
Far from resort of people that did pass
In travel to and fro.”

Here the happy, peaceful hours of its cell-life are spent. Fed by Him who feeds the birds, and clothes the field-flowers with their robes, and even cares for insects, its little day of life runs out, and the occupant of the cell either falls into the trance-like pupa state, or, if it be a perfect insect, breathes its last, and dies.



CHAPTER IV.

THE BATTLE-FIELD.

—— Read this other part, that sings
Embattled squadrons, and adventurous kings,
A mighty pomp, though made of little things,
Their arms, their arts, their manners I disclose,
And how they war, and whence the people rose.

VIRGIL'S *Georg.* b. iv.

WE are told in the sure word of Scripture prophecy, that there shall a time come, when men shall learn war no more, and when the weapons they have used in destruction, shall be turned to the peaceful purposes of agriculture. Contending nations shall own the reign of Him whose right it is, and whose government shall be distinguished by peace, quietness, and assurance for ever. Not only so, but the same Divinely inspired word fully declares that a reign of peace awaits even the brute creation. The lion and lamb shall feed together, and the venomous beasts of the earth



CHAPTER IV.—THE BATTLE-FIELD.

shall cease their deadly attacks upon each other, or mankind. The blessing, all-encircling, is to extend wider still, and it is promised that even vegetable creation shall manifest then, by its luxuriance and fruitfulness, the universal joy of all the earth during that peaceful era. Nor can we doubt that then, while harmony and peace pervade the rest of the renewed and liberated creation, the insect world shall experience its share in the same privileges, and it shall be said to the fierce armies whose sanguinary conflicts we are about to describe, "Be at peace among yourselves."

As yet, neither in human nor in insect society, do we behold any foretokenings of the advent of this reign of peace. Still burn the angry passions of the heart, and still nation rises against nation in our world, nor less in that of insects. The battles of insects, it is true, make less noise than do those of contending human armies, and many a conflict takes place in field and woodland, without the knowledge or recognition of the other inhabitants of those regions. But, except in the matters of noise and force, the battles of insect armies emulate in all respects the fury and the bloodshed of their superiors. Nor are we able to say

that insects prone to fight can make out any better *casus belli*, than more enlightened beings bent on picking a quarrel with their neighbours. It is the duty of the historian of every nation—even of insect nations, to state matters with strict impartiality, and it is therefore ours to remark that neither the animating motives of the combatants, nor the object of their wars, appear at all times to justify their occurrence. Alas! that wheresoever we look, the eye that will closely mark the aspect of creation and the habits of created beings, will find those evidences of imperfect happiness which plainly tell us, ours is a fallen world.

“ If,” says Huber, “ we wish to behold regular armies, war in all its forms, we must visit those forests in which the Fallow ants establish their dominion over every insect in their territory. We shall there see populous and rival cities, regular roads passing from the ant-hill as so many rays from a centre, and frequented by an immense number of combatants,—wars between hordes of the same species, for they are naturally enemies and jealous of the territory which borders their own capital. It is in these forests I have witnessed the inhabitants of two large ant-hills engaged

in spirited combat. I cannot pretend to say what occasioned discord between those republics. They were composed of ants of the same species, alike in their extent and population, and were situated about a hundred paces' distance from each other. Two empires could not possess a greater number of combatants."

In describing these conflicts we can only compare them with our own, and are therefore compelled to adopt the language suitable to human conflicts, for in the words of the last author, "we cannot invent a particular language for these insects, we must therefore make use of the terms employed when speaking of war."

Let us first speak of the munitions of war. Our combatants have no matchlocks, cannons, or projectile arms of any kind similar to our own: but they are furnished with no insufficient substitute in the receptacle of venom, situated at the lower part of the abdomen. A discharge of this acrid fluid is fatal to many enemies, not less so than is the reception of a bullet in some vital part of one of our own soldiers. It has been called by chemists—formic acid, from the Latin name of the ant, and may be extracted

from the insects by maceration in cold water. It is a pungent, acrid fluid, of very distinct acid properties. In addition to this somewhat formidable apparatus, the insect soldiers are furnished with a strong pair of trenchant jaws, than the wounds inflicted by which no gashes cleft by warrior's sword are more fearful. We have heard tell of various feats of arms accomplished by our warriors of old with their swords and spears, but the historian of insect conflicts can recount such deeds of valour as find few parallels in history. Only a few of our mighty men could slice off an enemy's head with one stroke of a falchion; but there is not a single soldier in the Amazonian ranks of ants who cannot do likewise, or even cleave in twain his adversary's body, or chop asunder his limbs. Altogether, the combatants, as we may imagine from these statements, have no need of powder, bullets, or cannon-balls, and still less of such weapons as daggers and sword-blades. In battle, although we cannot quite say with Chaucer, that their

“Bright swordes wenten to and fro,
So hidously, that with the leste stroke,
It seemed as it wolde felle an oake—”

yet so furiously are their substitutes for swords plied, as to leave little to be desired to fill up the measure of the comparison. As to courage and ferocity, they surpass the most warlike of human nations.

It matters nought to these redoubtable warriors what may be the size of their foe. Their courage is not quelled by an attack from man himself; on the contrary the warriors instantly face about when menaced, and put themselves into the attitude of fighting. If the attack be actually made, the valorous insect furiously expands its jaws, and ejects from its projectile apparatus a shower of venom upon the enemy. Cunning is almost unknown among their military devices; like brave and bold soldiers, their attacks are open, and generally in the face of day. The warriors are all females of the labouring class, the males and queen never appearing in battle.

But to the battle-field. We shall describe, strictly in accordance with truth, a great battle fought between the Herculean and the Sanguine armies. The Herculean warriors were strong and mighty, and of much greater stature than

those of the Sanguine army, being in fact half as large again. But the Sanguine warriors, though small, were wonderfully valorous, and feared not in the least the fury of their bulky opponents. The Sanguine citizens were peacefully pursuing their avocations, and, busy in the discharge of their multifarious daily duties, little thought of the probability of a hostile army being already on the march, and bent on the annihilation of the entire people of that kingdom. The Herculeans, occupying a highly advantageous site for their city, upon the trunk of a tree, and jealous of the thriving colony of the Sanguines at no great distance from their territories, although the latter do not appear to have given any special cause of offence, sallied forth one afternoon in innumerable hosts to the destruction of their rivals. The advancing army poured its swarms of warriors down the side of the tree, their polished armour glittering in the sunbeams, and their aspect and ferocity well calculated to inspire their enemies with terror and dismay. Legion after legion came down, and the earth was now covered so thick with the Herculean host, that not a blade of grass

was visible. Alas ! for the Sanguine citizens, as yet ignorant of the approaching destruction. Suddenly the wild intelligence flew through the Sanguine kingdom that the enemy was at the gates ! and that the sentinels were already in the agonies of death. As if by magic, countless thousands of the Sanguine citizens, all ready armed, flew to the rescue. From the deepest recesses of the city, from its halls and galleries, from its winding avenues and cells, warrior after warrior rushed to the scene of battle.

Their attitude at first was purely defensive. They appear to have felt the immediate necessity of removing their dwelling-place to a distance from such undesirable neighbours, and their efforts were all directed rather to keep the enemy at bay, and in action, than to wage a pitched battle. While, therefore, a certain body of the Sanguine warriors contended furiously with the advance legions of the enemy, another portion were hard at work in the act and business of decamping from their city. These latter, full of agitation, might be seen snatching up their precious young charges, and rushing off with them between their jaws, carrying them as tenderly

as circumstances admitted of, to a place of safety at some distance. In this act of transporting their baggage, and the young of the community, they exhibited their usual prudence, and it may be seriously questioned whether human tacticians could have better arranged matters than did they. Small detachments of warriors were posted at little distances so as to cover the march of the decamping citizens, and their task was rendered no easy one in consequence of the well-directed attacks of the Herculean soldiers.

The transportation effected, the Herculean army attacked the assembled Sanguine host, and now the tide of battle rose strong and high. On came the Herculean warriors, proud of their strength, and making the blades of grass to tremble at their sound, but more fiercely onward rushed the Sanguine host. Conscious of the force gained by impetus, every Sanguine warrior dashed upon its immense opponent, probably somewhat to the surprise of the latter. Leaping upon the Herculean's head, the agile Sanguine directed its projectile apparatus with such skill as to inundate the chest and mouth of its adversary with the suffocating fluid. With equal

agility the Sanguine would then leap off its antagonist, and rush upon a second foe, leaving the first in no very desirable plight. But more frequently the valorous Sanguine experienced a very different reception at the hands of its Herculean antagonist. The strong Herculean would often seize the little and active fighter and hold it in a suffocating embrace between its feet. Then both warriors violently struggled with each other, and rolled over and over in the dust and blood of the battle-field. And now little hope remained for the poor Sanguine, the fight depending more upon physical strength than valour. Desperate was their fury, invincible their obstinacy. The Sanguine again and again thrust its sharp weapon into its opponent's body, but in vain; the Herculean seized it suddenly between its jaws, the Sanguine all the while clenching hold of its adversary's leg, and snapped its body in twain. So might overcame right, and neither the righteousness of the Sanguine's cause, nor the intensity of its valour, could avail to turn the scale of battle in its favour as an individual. Yet, on the other hand, neither did the Herculean come off unscathed, for, wounded and limping it crawled

away, bearing a painful evidence of its past conflict, and of the determined obstinacy of its tiny opponent in the head and jaws of the latter remaining firmly fixed on one of its legs, beyond the power of extrication. To its latest hour the Herculean carried that trophy about with it, not resigning it even in the agonies of death.

Sometimes the result was different. On perceiving the inequality of the contest several Sanguines would rush up to one of their companions, and collecting around the infuriated combatants, would pierce the body of the Herculean with several deep wounds. The Herculean relaxed its gripe, yielded to the numbers which surrounded it, and either perished, the victim of its temerity, or was conducted a prisoner to the enemy's camp.

After much carnage, after many valuable lives had been lost, after great damage done on both sides, the battle ended. The Herculeans encroached no more, and the brave Sanguines went on with their usual employments. It seems a pity they had not agreed to do so before they began, as in reality no advantage was got by the contending parties, which might not have been

equally well obtained by an amicable arrangement. Such, however, is the history of too many battles, not alone in the insect world. On the whole, the conduct of the Sanguine ants, in the conflict thus described, was highly deserving of praise, since they were the attacked, and the others the invading party.

The battles of the Sanguine and Fallow ants, as regards the skill with which they are conducted and the method in which the military operations are carried forward, bear no inconsiderable resemblance to the wars in which we ourselves engage. The Sanguine ants, when they are attacked by the Fallow ants, go and await the enemy in little troops at some distance from the nest. They then advance in a body, without separating, and seize all those of their enemies who venture too far from their camp. These skirmishes are highly amusing. The two parties place themselves in a sort of ambuscade, and suddenly attack each other in turns. But these skirmishes become increasingly serious, and a great battle is commonly decided upon. The Fallow ants resolve to send a large body of troops into the field in order to put a check to the guerilla warfare,

which is cutting down their best warriors. No sooner do the sentinels of the Sanguine detachments recognize the advancing host of the Fallow ants, than they inform the inhabitants of their kingdom of the need in which they stand of immediate reinforcement. Despatches are sent off in haste to the army at home, and great excitement is created. Immediately a considerable army leaves the Sanguine city, advances in dense masses, and the conflict begins.

“The seas, and rocks, and skies rebound,
To arms, to arms, to arms!”

The dimensions of the battle-field were about two paces in length by one in breadth; but here were marshalled in tolerable order two opposing armies, each of which was many thousand strong. The battle commenced, the opposing legions fell upon each other with equal courage, and as yet with equal fortunes. Quickly each

—— “Warriouresse, with haughty crest,
Did forth issue, all ready for the fight;
On th’ other side her foe appeared soone in sight.”

Both sides being without generals, field-m Marshals, or other superior officers to direct their movements, engaged in an irregular conflict. Every war-

rior singled out his opponent, and the battle was thus made up of a number of single combats. But it was none the less furious. Although, neither party had flags or standards, nor were assisted in their recognition of their own party by the voice of the trumpet, yet rarely was there any confusion of the hosts, and very rarely did one infuriated warrior fall upon another of his own side by mistake. Whenever a mistake was made, the attacking insect immediately recognizing its error, relaxed its murderous gripe, and made its apologies by caressing its injured fellow with its antennæ.

All Nature was at peace, apparently, while this fearful battle was being contested.* The sun shed its beams joyously upon the herbage, flowers, and trees; and the wind sighed gently over the fields. But the contending hosts were all engrossed in their conflict, and fought with unmitigated fury in the parting rays of the declining sun. The shadows of evening lengthened out, but ere their close in the full darkness of night, the conflict had terminated, and each party was seen retiring with their prisoners homeward. It might have been expected that here this insect war would have ended, but not so.

* See Frontispiece to this Chapter.

The morning came, and ere the grey light had brightened into day, the contending parties entered the battle-field, and the fight was immediately recommenced. The sun arose upon the combatants doing battle with even greater fury than before. Again, ant fell upon ant, and a mortal struggle for the mastery ensued. Re-inforcements arrived perpetually from both cities, and thus kept up the ferocity of the contest. Detachments of soldiers, weary with the prolonged struggle, were sent off to the city, taking charge of the prisoners taken in fight. Showers of venom were discharged from the projectile apparatus of the insect armies, and a thin sulphureous vapour rising therefrom, covered the battle-field with a pall, under which the legions fought with unabated fury. Another day closed upon them still fighting, though now with reduced numbers.

Again, before dawn, the battle was recommenced. It now appeared that nothing short of the entire annihilation of both kingdoms was impending. There was little prospect of either party being victorious, although both were

“Tugging to be victors, breast to breast,
Yet neither conquerors nor conquered.”

No advantage had been gained by either army, and the position of affairs seemed much the same as it was when the fight began, but that a terrible slaughter had thinned the opposing hosts. At length the battle ended, whether in consequence of the exhaustion of the forces of each party or of a heavy shower of rain, cannot be exactly said. But, at any rate, the armies withdrew to their respective citadels, and fought no more. Alas ! what a field of battle had they left. There lay the bodies of some thousands of brave soldiers that but for this unhappy conflict had been busily engaged in the useful occupations of peace. Heaps of mangled limbs lay scattered around. Here lay a body without the head. Here were a trunkless head and dissevered legs. The dead bodies and limbs being covered with venom. When all was over, no good had been effected ; not even victory had been gained ; and the opposing armies separated, after a vain but sanguinary attempt to annihilate one another, greatly to the loss of their several communities.

A combat of a somewhat dissimilar character is described by Mr. Knapp in the following terms :—“ These systematic creatures appear al-

ways to travel from, and return to their nests in direct lines, from which no trifling obstacle will divert them; and any interruption on this public highway they resent, menacing the intruder with their vengeance. A neighbour related to me an instance of this unyielding disposition, which he witnessed in one of our lanes. Two parties of these black ants were proceeding from different nests, upon a foraging expedition, when the separate bodies happened to meet each other. Neither would give way, and a violent contest for the passage ensued. After a time, the combat ceased, and all animosity subsided, each party retiring to its nest, carrying with it its dead, and maimed companions. This encounter seemed quite accidental, and the disposition to move in a uniform line, which their meeting prevented, the sole cause of their hostility, combat, and mutual injury.”*

Sometimes these combats do not take place on the earth but in the air,—

“ In the fields of light
The shocking squadrons meet in mortal fight.”

A correspondent of the “ Entomological Maga-

* “ Journal of a Naturalist,” p. 300.

zine" relates the following interesting aërial battle.

In the summer of 1828, a relative of mine was attracted by the singular actions of some sawyers, who were at work at a short distance from the house in which he was staying. On reaching them, he found they were annoyed by an immense body of ants flying above their heads, numbers of which were incessantly falling on them. The saw-pit was situated between two trees, one of which appeared to be the station of an army of black, the other of an army of red ants. After each army had been flying for a while round the tree of which it had taken possession, both, as by some mutual signal, rushed forward, and, meeting in mid air, commenced a most desperate battle.

As they fought, numbers fell to the ground, and always in pairs, one black, and the other red; and, when thus engaged, as it were hand to hand, each pair continued the horrid combat until one or both were completely disabled, and unable again to rise. At last a truce was sounded, and each party retired to its respective post; but, alas! this was but for a time, it was

only to recover their strength, and recruit their exhausted energies. Burning with cruel rage and insatiable revenge, each party again rushed into battle; again the horrors of war were repeated and prolonged, and again they retreated. This continued during the whole day; and the carnage did not cease till the sun was below the horizon. The air was then deserted by the combatants; but the earth was strewn with the slain, the dying, and maimed. Not one that bit the dust ever again left the earth, to which his own rashness and savageness had brought him !

The most perfectly organized army in the world of insects, is to be found in the tribe of the warlike Termites of the tropics. Almost all that we know as to these remarkable creatures is contained in a paper by Mr. Smeathman in the "Philosophical Transactions" for 1781. After a minute account of the constitution of this remarkable insect society, and of the astonishing cities it constructs, Mr. Smeathman states some highly interesting particulars concerning them. Unlike other warlike tribes, these insects have an army of military, entirely distinct from the

labouring classes of the community. As with ourselves, the soldiery do nothing else but fight, and the insect soldiers really appear to be unable to fulfil any other duty. The work of repairing the city, and fortifications, and all the other business of the community, is fulfilled by the labouring classes. The soldiers are not so numerous as the latter, but they are strong, powerful creatures, and are armed with a fearful pair of jaws. In disposition they are the most fierce, obstinate, and implacable creatures in the world. The following interesting account of the behaviour of these insects when attacked by an enemy is extracted from Mr. Smeathman's paper.

“The first object which strikes one upon opening their hills, is the behaviour of their soldiers. If you make a breach, in a few seconds a soldier will run out and walk about as if to reconnoitre. It will sometimes go in as if to give the alarm, but most frequently may be followed by two or three others, who run straggling after one another; and to them succeed a large body who rush out as fast as the breach will permit them; and the number increases

as long as any one continues battering the building. It is not easy to describe the rage and fury which they show. In their hurry they frequently miss their hold, and tumble down the sides of the hill, but recover themselves as quickly as possible ; and, being blind, bite everything they run against, thus making a crackling noise, while some beat repeatedly with their forceps upon the building, and make a small vibrating noise something shriller and quicker than the ticking of a watch ; it can be heard at three or four feet distance. They make their hooked jaws meet at every bite ; and, if it should be the leg of a man, a spot of blood extending an inch on the stocking follows the wound. Nothing can tear them away, but they must be taken off piecemeal. If, on the other hand, you cease to batter, in half an hour they retire into the nest, as if they supposed the wonderful monster that damaged their castle to be beyond their reach. The labourers who had fled on the first alarm, are now seen hastening to repair the breach, every one with a burthen of ready-tempered mortar in its mouth. This they stick on to the breach with such

wonderful celerity and order, that, although thousands, nay, millions seem employed, yet they never embarrass one another. While the labourers are thus engaged, the soldiers retire, save here and there one who saunters about, never touching the mortar. One in particular places itself close to the part undergoing repair : it may be seen turning leisurely on all sides, and every now and then, at an interval of a minute or two, lifting up its head, and with its forceps beating upon the building, and making a vibrating noise, on which a loud hiss, apparently from the whole body of labourers, issues from withinside the dome and all the subterranean passages : that it comes, from the labourers is very evident, for all these may be seen hastening at every such signal, redoubling their pace, and working as fast again. Attack the nest again, and with a loud hiss the labourers disappear, and the soldiers rush out ; so that the experiment yields constantly the same result ; of labourers at work, and soldiers rushing to battle, the duties of each being as distinct as night and day."

Some of the species of Termites are occasionally to be seen marching in great pomp, and

with all the order of human troops. The labourers form into columns sixteen abreast, and commence their expedition, marching in a strictly straight line. They are here and there accompanied by an escort of soldiers, the latter arranging themselves on both sides of the line of march, a few soldiers also are found in their midst like policemen in a mob, and perhaps placed there for similar purposes. Others of the soldiers keep a foot or so from the column, acting as videttes, appointed to guard against a surprise. Others mount the blades of grass as sentinels, turning their heads in different directions, and every now and then signalling to the marching squadrons below, by striking their forceps against a leaf, a signal to which the whole army replies by a loud hissing sound, and redoubles its pace. There is also a heavy rear-guard of soldiers which protects the retreating columns. Millions upon millions must unite to form these dense marching columns.

The contests of the bees were known to the ancients, and have been described in glowing terms, but with many inaccuracies, by the poet Virgil. Réaumur has given the particulars of a

great battle which he beheld among these insects. The cause of war was the following:—A swarm of bees which Réaumur had attempted to reconcile to a glazed hive, appeared greatly to dislike the apartments he offered them, and several times abandoned them with their queen. At length, in an evil hour, the queen and her subjects determined to invade a populous hive, hard by their own, and they crept in at its portals. Scarcely had they entered when a terrible uproar was raised in the large hive, its winged inhabitants becoming furiously enraged at the audacity of the invaders. Instantly a general action commenced. Unfortunately the hive was not constructed so as to afford a view of the fight, but from several skirmishes which took place outside the hive, the general idea of the conflict may be formed. Two combatants would emerge, the one dragging along the other, and endeavouring to trample its prisoner under foot. If successful in mounting upon the prostrate foe, woe to the latter! The victorious insect seized its victim between its powerful jaws, near to its head, and bit it with great force. Almost instantly the poor vanquished bee, in all probability pierced

through with the envenomed weapon of its adversary, was either dead or dying. The victor immediately left the body of its expiring foe, remaining, however, close by it, as if in triumph, or to rest from its fatigue. While resting, as if in satisfaction at its deed of death, the victor bee would rub its hind legs against each other.

Similar scenes were no doubt enacted within the hive, from out of which sounded the tumult of battle. Every now and then, emerging from its portal, would be seen a victorious bee, carrying in triumph the carcase of a dead foe between its legs. The bee would emerge flying, and, sometimes at a little distance, sometimes at a greater, would deposit the corpse upon the ground. Sometimes, however, the captive was not quite dead; the victor then, after flying with it to a little distance, presently despatched it. It is highly remarkable that the bees are well acquainted with the exact position of the mortal parts of the body of their enemy. We ourselves are not able to destroy one of these little insects, if we do not actually crush it at once, half so speedily as is one of its companions.

This terrible combat lasted from half-past one

o'clock in the afternoon until five o'clock, and the massacre all the time continued frightful. It is indeed conjectured by Réaumur that all the invaders were destroyed, but of this he could not, of course, satisfactorily assure himself. He collected, with his own hands, two hundred and fifty corpses off the battle-field, and might have gathered more if necessary. In addition to these, many were carried off to a distance, and the ground in the vicinity of the invaded bee-city was strewn here and there with the dead or dying, victims to their own audacity, and infringement of the laws of nations.

Mr. Knight has given us an amusing account of two bee-battles of which he was spectator, under some singular circumstances:—"Passing through one of my orchards, rather late in the evening, in the month of August, in the year 1801, I observed that several bees passed me in a direct line from the hives in my own garden to those in the garden of a cottager, which was about a hundred yards distant from it. As it was considerably later in the evening than the time when bees usually cease to labour, I concluded that something more than ordinary was going forward.

Going first to my own garden, and then to that of the cottager, I found a very considerable degree of bustle and agitation to prevail in one hive in each ; every bee, as it arrived, seemed to be stopped and questioned at the mouth of each hive ; but I could not discover anything like actual resistance or hostility to take place, though I was much inclined to believe the intercourse between the hives to be hostile and predatory. The same kind of intercourse continued in a greater or less degree during eight succeeding days, and though I watched them very closely, nothing occurred to induce me to suppose that their intercourse was not of an amicable kind. On the tenth morning, however, their friendship ended, as sudden and violent friendships often do, in a quarrel ; and they fought most furiously, and after this there was no more visiting.

“ Two years subsequently to this period, I observed the same kind of intercourse to take place between two hives of my own bees, which were situated about two hundred yards distant from each other : they passed from each hive to the other just as they did in the preceding instance, and a similar degree of agitation was

observable. In this instance, however, their friendship appeared to be of much shorter duration, for they fought most desperately on the fifth day; and then, as in the last mentioned case, all further visiting ceased."

Messrs. Kirby and Spence have furnished us with an extract from the Carlisle Patriot Newspaper, which describes a combat of bees almost to the letter in the same manner as Virgil, who appears to have written from actual observation, describes the same circumstance in the early part of the fourth Georgic. The newspaper extract is as follows:—

"On Saturday last, a combat of a truly novel description was witnessed. A hive of bees belonging to a professional gentleman of this city, swarmed on Thursday last, after which they were hived in the regular way and appeared to be doing well. On the Saturday after, a swarm of bees, from some neighbouring hive, appeared to be flying over the garden in which the hive above-mentioned was placed, when they instantly darted down upon the hive of the new settlers, and completely covered it; in a little time they began to enter the hive, and poured into it

in such numbers that it soon became completely filled. A loud humming noise was heard, and the work of destruction immediately ensued: the winged combatants sallied forth from the hive, until it became entirely empty; and a furious battle commenced in upper air between the besiegers and the besieged. These intrepid little warriors were so numerous, that they literally darkened the sky overhead like a cloud; meanwhile the destructive battle raged with fury on both sides, and the ground beneath was covered with the wounded and the slain, hundreds of them were lying dead or crawling about, disabled from re-ascending to the scene of action. To one party, however, the palm of victory was at last awarded, and they settled upon the branch of an adjoining apple-tree, from which they were safely placed in the empty hive, which had been the object of their valiant contention, and where they now continue peacefully and industriously employed in adding to the stores of their commonwealth."

The beauty of Virgil's lines justifies our extracting a few of them into our page. Their close similarity to the above account deserves

notice, allowing always for poetical embellishments.

“Inflamed with ire, and trembling with disdain,
Scarce can their limbs their mighty souls contain :
With shouts (!) the coward's courage they excite,
And martial clangors call them to the fight ;
With hoarse alarms the hollow camp rebounds,
That imitate the trumpet's angry sounds :
Then to their common standard they repair,
The nimble horsemen scour the fields of air,
In form of battle drawn they issue forth,
And every knight is proud to prove his worth.”

After this glowing description of the sally forth to the fight, Virgil informs us of two or three particulars more poetical than true, among which is the curious piece of intelligence that the bees “sharpen their stings” by whetting them on their “beaks!” His account of the actual conflict, however, is as beautiful as it is correct.

“Headlong they fall from high, and wounded wound ;
And heaps of slaughtered soldiers bite the ground.
Hard hailstones lie not thicker on the plain ;
Nor shaken oaks such showers of acorns rain.”

After describing an imaginary duel between

the two monarchs of the contending nations, which he erroneously calls kings, he quaintly adds the following lines :

“ Yet all these dreadful deeds, this deadly fray,
A cast of scattered dust will soon allay,
And undecided leave the fortune of the day.”

In spite of many inaccuracies, there are evidences in this Georgic that the poet was a close observer of nature, going wrong only when depending on the accounts he probably received from others, or when suffering himself to be led astray by the exuberance of his poetical fancies.

Battles sometimes occur between a very different class of opponents to those commonly met by insects on the field of contest, and it must be confessed, not unfrequently insects are the conquerors. One of these attacks of insects upon man, has already been described in an extract from Lieutenant Holman's travels. A similar fact, and even a more striking one, is recorded by Mungo Park. He says: “ We had no sooner unloaded the asses at the creek, than some of Isaaco's people, being in search of honey, unfor-

tunately disturbed a large swarm of bees near where we had halted. The bees came out in immense numbers, and attacked men and beasts at the same time. Luckily, most of the asses were loose, and galloped up the valley; but the horses and people were very much stung, and obliged to scamper in all directions. The fire which had been kindled for cooking, being deserted, spread, and set fire to the bamboos, and our baggage had like to have been burnt. In fact, for half-an-hour, the bees seemed to have completely put an end to our journey. In the evening, when the bees became less troublesome, and we could venture to collect our cattle, we found that many of them were very much stung and swelled about the head. Three asses were missing: one died in the evening, and one next morning, and we were forced to leave one at Sibikillim, in all six; besides which, our guide lost his horse, and many of the people were very much stung about the face and hands!" On another occasion one ass was lost, and a man well nigh killed by these formidable winged warriors.

We are told that the occasion has once occurred in which man actually called in these aërial com-

batants to his assistance, when attacked by his fellow man. It was in 1535, during the confusion occasioned by a time of war, that a mob of infuriated peasants assembled in Hohnstein, and attacked, among other places, the house of a gentleman who had some hives of bees in his garden. After in vain expostulating with them upon the unreasonableness of their attack, this gentleman bethought him of his faithful allies in the garden, and despatched his servants for several of the hives. They were thrown into the middle of the angry mob, and in an instant, some forty or fifty thousand warriors emerged from them, and fell upon the multitude. Amazed and terrified at the appearance of this new enemy in the field, the people fled in all directions, and the gentleman's house, in a surprisingly short space of time, was left totally unmolested!

Sometimes, however, man is the attacking party, as will appear from the following extract.* "I left Bainer," writes Mr. Arundel, "at seven o'clock, accompanied by all the great Turks, armed from head to foot with muskets, pistols,

* Discoveries in Asia Minor, by F. T. V. Arundel, British Chaplain at Smyrna.

and yatagans, in grand procession—to exterminate the locusts! I was awoke at a very early hour by the Turkish tambour, which was beating a summons for the entire population, Turk, Christian, and Jew, to rise *en masse*, and sally out to destroy these destructive insects:—arrived on the field of action about eight o'clock. The hedges were darkened by the masses of locusts, though not of more advanced growth than a large fly. Hundreds of people were to be seen. Turks, Jews, Greeks, Armenians, grouped in all directions, brushing the locusts together in immense heaps with bushes, &c. at the beat of the tambour; and then, with a thundering hurrah, jumping upon the heaps and killing them. Other parties took a different mode, by sweeping the masses into a small stream, where, like immense swarms of bees clustered together, they sank to the bottom.”

We are told by another author, that the locusts proved such formidable enemies on one occasion in Syria, that the Bashaw of Tripoli raised a force of four thousand soldiers to wage war with them. Some of his men thought it beneath them to contend with insects, but they were soon

silenced by a peremptory order to hang up all those who refused to take the field against the locusts. Locusts have also been contended with at the cannon's mouth, but their numbers generally ensure to the insects the victory.

The scenes recorded in this chapter of insect-history, though highly interesting in themselves, leave upon the mind a reflection of sadness, if not of pain, in their contemplation. Well may Huber exclaim "Is war inseparable from a state of society?" Looking at the ants and bees as a community, where shall we find a more just equalization of labour, a more devoted loyalty, a more affectionate and friendly intercourse of the individuals of the community with one another? and we have yet to see a fuller exhibition of those social virtues which shine scarcely more highly in superior beings, than in these humble insects. Yet where, at the same time, shall we see displayed, passions more fierce, and revenge more implacable than we behold in the Insect Wars? In vain, therefore, do we seek even among the most highly-endowed insects, those principles of peace and love which could render their history without a blot, and their

community an example to mankind. They are poor, weak, irascible creatures at their best estate, and while appearing highly well-conducted and happy in the city, their aspect is fierce and unpleasing, and their example evil, when we behold them marshalled in the battle-field.



CHAPTER V.

INSECT DUELS.

WE must now descend from generals to particulars, and having narrated the combats of insect nations, it becomes us in pursuing our account of insect habits to advert to a few cases of the single combats, which are even more frequent among insects than the battles of nations. We can no more justify the proceedings of insect duellists than those of insect warriors, in many of these fierce onslaughts. Indeed of the latter it may be said that they are occasionally perfectly justifiable in consequence of the infringement of international laws. If amongst ourselves it is considered a great and righteous cause to take up arms in defence of our country, we must extend the same justice to insects, and are bound to admit, that when acting on the defensive, and simply with a view to resist the ingress of an



CHAPTER V.—INSECT DUELS.

enemy and a destroyer, their battles have a most just cause; and may right always prevail against might! Upon other quarrels and causes of war the insect apologist must be silent, or may even admit to the full that they do not justify the carnage which accompanies them. We fear, however, little can be truly said in palliation of the mutual combats of insects. Their valour is not excited to defend an endangered country, but to avenge a fancied insult; and when either or both of the combatants perish, they die wholly without the consolation of having perished in a good cause. Yet this much can be said for insects, that, unlike the duellists of another race, they have only the light of nature for their moral guide; and to them it was never said from on High, as to ourselves, "If thine enemy hunger, feed him; if he thirst, give him drink;" nor yet "Be ye tender-hearted, forgiving one another even as God for Christ's sake hath forgiven you." We shall yet find, before we close this little volume, that though insect history has this blot on its page, it contains also many a bright line from which instruction may be gathered by us all.

The causes which lead to the duels of insects

are various. Sometimes they are hidden in obscurity, and it is impossible to say what inspires the combatants with their mutual fury. Frequently, however, the intrusion of a stranger into their society seems to excite instantly their angry passions, and a combat is the immediate result. Many insects seem instinctively to dread or hate those of the same tribe with themselves, and will fall ferociously upon each other the moment they espy one another out. When this is the case, one or other is pretty sure to perish, and if so, to be eaten up altogether. We are less surprised at incidents of this kind in the history of solitary insects, which were never intended to be placed in company with each other; but it is very puzzling to see social insects, the members of a common republic, and ordinarily the most excellent, helpful, and faithful friends, fight each other to death. Réaumur, indeed, eyeing his humble insect friends with a kind and perhaps partial look, apologizes in an ingenious manner for the duels of bees. "Were we permitted," says he, "to penetrate the policy of the bees, we should probably find, to their credit, that their quarrels are not often produced

by the frivolous causes which excite similar quarrels among ourselves. We may not perhaps extend to them the charity we extend to savages, who think they are doing an act of kindness to the aged and infirm in shortening their days, knowing that they would otherwise be spent in pain and privation; but there is at least the probability that it is for the welfare of the community, which alone appears to actuate them, that bees engage in these single combats, the intention of which is to destroy those who can no longer benefit the state." If such indeed, be their motives, the duels appear less unjustifiable; but Réaumur's charity led him, it may be, too far, for bees are well known to be a most irritable race; and it seems strange that a work necessary, on this supposition, to the well-being of the community, should be undertaken by a single individual on its own responsibility, and with the imminent risk of being itself the vanquished instead of the victor. It would appear more probable that these hot-tempered little insects take some quick offence at one another, and resolve to settle the matter in hand by a duel. Be this as it may, let us seek the pre-

cincts of the city of the bees, and become the spectators of one of their duels.

To do this we must select some fine warm day, and if we are patient observers, we shall not often fail of seeing the spectacle in question. Sometimes both combatants sally out of the hive, already in the full act of fighting; and not unfrequently a bee will be seen quietly walking up the outside of the hive, or even at rest, and its adversary will suddenly pounce upon it, and the combat begins. So soon as the combatants are mutually engaged, they generally fall down to the ground. It appears that they could not contend with each other to much advantage in the air, from the difficulty of inflicting a mortal wound, and of at the same time sustaining themselves therein. On the ground the enraged duellists imitate the action of wrestlers in a mortal struggle. Each one takes up that position which it considers to be the most advantageous. Sometimes both lie struggling, fast held together, in the dust, plying their wings furiously, and spinning round and around, but not rising from the earth. One of them, however, succeeds at length in obtaining a more favourable position

than the other, mounts upon its back, and attempts to bring the hinder part of its body near the head of its prostrate foe, so as to thrust its poniard into it. So absorbed are they then in combat that they are utterly heedless of the presence, and even close scrutiny of the observer. Engrossed with the furious determination to conquer or perish, each is too much occupied in its defence and attack to regard surrounding objects. During this conflict they continually make thrusts with their stings; and all their strugglings, and all the positions into which they throw themselves, appear to have the sole object of discovering some vulnerable part of the adversary's body, into which this formidable weapon can be thrust. The horny epidermis with which each is clad, forms a complete coat of mail, through which the darts of the duellists are not easily thrust. The most vulnerable parts are near the neck, and the extremity of the abdomen, and here, like two practised swordsmen, the combatants chiefly direct their glittering weapons.

These combats often last a considerable time. Réaumur says he was spectator to one which lasted almost an hour! one of the duellists at

the expiration of that time being left dying on the ground. Sometimes both combatants are so weary of the prolonged struggle, and apparently despairing of bringing it to an issue, that they part and fly away. If both have escaped the darts of their adversary, both will probably survive, and for aught we know to the contrary, the quarrel may be so entirely forgotten, that the duellists may again exchange friendly intercourse. But if either has received a wound from the other in any fleshy part, a fatal result is sure to follow. However minute the quantity of venom, the wounded bee is beyond the reach of cure. Sometimes, however, the victor itself perishes, by leaving its weapon in the body of its dying foe. The sting, with all its connected parts being thus torn violently away, the wound is incurable, and both insects pay the penalty of their encounter with their lives.

The insect relatives of the "Father Long-legs," and even the "Father Long-legs" itself, are sometimes to be met with in the heat of a duel. Mr. Westwood tells us, "in walking home at dusk one evening, I heard a considerable rustling of insects' wings, like those of a dragon-fly

when flying amongst twigs, and immediately perceived two specimens of this insect, *Tipula gigantea*, flying across my path. I seized them and was surprised to find that they were two individuals of the male sex. In like manner I captured two male specimens of a smaller species allied to *Tipula oleracea*, in the evening, flying together above my head, and fighting apparently with great violence. And this reminds me that some years ago I found two male specimens of *Trichiosoma lucorum*, rolling about on the ground, having seized each other with their large and powerful jaws. Deadly battles between rival queen bees have been recorded, but I am not aware that any of these encounters between individuals of the opposite sex, incited, as we may perhaps justly suppose, by jealousy, have been recorded."

Duels have also been recorded between those formidable creatures, the stag-beetles. An observer in the "Entomological Magazine," having confined two of these creatures, under a glass, saw the largest of the two turning round and attacking his smaller companion. The other, intimidated probably by the ferocious aspect of its foe, betook himself to his legs, and ran

round the side of the glass, hotly pursued by the first. The larger insect repeatedly pinched the fugitive severely with his strong jaws, and actually lifted him off his legs into the air. Taking compassion upon the latter, the observer withdrew him from the glassy prison, and from the assaults of his frightful foe. Such is the pertinacity of life in these insects, that in a mutilated specimen from which the abdomen had been torn, the powerful jaws still could give a severe bite, and actually did so, to the surprise of the person who picked it up.

There is a species of beetle common in the south-eastern parts of Europe, which exhibits the same pugnacity of character. This creature digs a comfortable burrow in the ground, in which with its partner it dwells securely. But now and then an intruder in his travels will happen to look in at the door of this subterranean mansion;—the result may be easily anticipated. The inmate, who is a muscular powerful fellow, with very strong jaws curiously shaped, rushes out, and failing to get a satisfactory account of the intruder's object in trespassing

on the sanctity of his earthen home, immediately challenges him to a fight. The other not less bold, and perhaps anxious to secure to himself so comfortable an abode as he has just peeped into, accepts the challenge, and the duel instantly begins. We may be sure, while this contest is going on, there is a great scuffling and tearing up of the ground, and the partner of the insect whose citadel has been invaded, doubtless, sits in her dark cavern awaiting with anxiety the result. The battle is carried on with great violence, and the issue is a long time doubtful, but it is at length decided either by the slaughter of one or other of the combatants, or by the precipitate retreat of the impertinent intruder.

Alas! that we have to call butterflies to account for their duelling propensities. No one who has cast even a casual glance on the natural objects presented to him in his every-day walks not only in the country, "which God has made," but in the "town made by man," can have failed to have seen a duel between two of the common white butterflies, which give somewhat of a country air even to the dismal green patches of vege-

tation in the centre of our London squares. See one fluttering along in its irregular, and apparently objectless course, in the full joy of life and of the summer air; presently it will be met by another, and a duel is immediately fought. The pugnacious insects rise into the air, tussling with each other, and striking against one another with some force. These combats are not however on any occasion mortal. Each insect probably gets some ruffling of its plumage from the blows of its antagonist, but after they have fought a little time, they part, and each flies away, if indeed, as not unfrequently happens, both the eager and unheeding combatants have not had their duel cut short by some watchful bird, which devours them both in an instant.

Of all butterflies, however, the little elegant blue Argus butterfly is the most fierce and formidable duellist. This little creature seems scarcely to know what fear is. "When fully animated," observes Mr. Knapps, "it will not suffer any of its tribe to cross its path, or approach the flower on which it sits with impunity; even the large admiral (*Vanessa atalanta*) at these times it will assail and drive away.

There is another small butterfly (*Papilio phlæas*), however, as handsome, and perhaps still more quarrelsome, frequenting too the same station and flowers; and a constant warfare exists between them. We shall see these diminutive creatures, whenever they come near each other, dart into action, and continue buffeting one another about, till one retires from the contest: when the victor returns in triumph to the station he had left. Should the enemy again advance, the combat is renewed; but should a cloud obscure the sun, or a breeze chill the air, their ardour becomes abated, and the contention ceases.

“The *Papilio phlæas* enjoys a combat even with its own kindred. Two of them we seldom disturbed when basking on a knot of asters in September, without mutual strife ensuing. Being less affected by cold and moisture than the argus, they remain with us longer, and those contentions are protracted till late in the autumn.” The argus, however, pays for its fiery spirit with the loss of its beauty; for, adds our observer, “The pugnacious disposition of the argus butterfly soon deprives it of much of its beauty; and unless captured soon after its birth, we find

the margins of its wings torn and jagged, the elegant blue plumage rubbed from the wings, and the creature become dark and shabby!" It has been suggested that these encounters are not actually hostile, but are simply sportive. Let us hope,—it must be confessed rather against hope, since the actions of the little blue butterfly just described appear too manifestly hostile to be mistaken,—that in many cases it is so.

We have to record an insect duel, the particulars of which are so surprising, that were they not attested in the most indubitable manner, we might be well justified in refusing credence to them. In this duel a weapon not unlike a pistol in its action, is actually employed, and its discharge, though not attended with fire, is accompanied both by an explosion and a cloud of smoke! The combatants are the calosoma, and the bombardier-beetle (*Calosoma inquisitor*, and *Brachinus crepitans*). Let us bring them on the scene. The bombardier, which loves to creep about among stones, under which a large party of its fellow-artillerymen pitch their tent, has been espied by its great enemy the calosoma. The latter, being much more nimble than the

bombardier, rushes towards it, and approaching nearer and nearer discloses those fearful jaws, into whose dreaded grasp the poor bombardier seems fated to fall. The latter runs away at first as fast as it can flee, but the enemy, more agile in its movements, gains upon it at every step. The fugitive perceiving this, resolves to stand the brunt of a contest with its adversary. Our anxieties for the fate of the bombardier now reach their climax, and the case seems almost hopeless. Just when the calosoma appears to have but one step more in order to secure its victim, suddenly a loud explosion is heard, and a curling blue vapour rises into the air. The bombardier has shot its enemy full in the face, and may be now seen flying with all speed.

But the calosoma has not been mortally wounded. It appears wonderfully perplexed, and is, for the time, so stunned, as to be unable to renew the pursuit. The effects of the explosion, however, only proving temporary, it recovers itself, and the chase is continued. Infuriated at its disappointment, the pursuer urges its way onward, after the fugitive bombardier. Again it gains upon the latter, again the event-

ful moment of the capture seems at hand, when the bombardier turns round, and again discharges his piece in the enemy's face. The same effects ensue. The calosoma stupified, and in all probability to some extent injured by the powerfully acrid fumes which cover its face, again gives up the chase, and again, upon recovering, renews it with redoubled ardour and swiftness. The same extraordinary action is repeated again and again by the bombardier; and the little artilleryman, so expert in the use and timing of the discharge of his weapon, often escapes altogether, leaving the calosoma in no very desirable plight, on the field of battle. Sometimes, however, the result is different, and whether by stratagem, or by speed, the calosoma pounces upon its victim, and eats him up, together with his weapons!

This may read almost like fable; and it becomes therefore necessary to explain that the *Brachinus*, or bombardier-beetle, is provided with a remarkable apparatus at the extremity of its abdomen, which secretes a peculiar chemical fluid, which can be expelled in certain portions at the option of the insect. This fluid, immediately on its expulsion, seems to undergo decomposition in

the air, and bursts into a little cloud of smoke. It does not appear to have been as yet ascertained, what is its exact chemical composition. In all probability it is some peculiar organic compound. It is stated by a correspondent of the "Entomological Magazine," that on putting a bombardier into boiling water, it let off one of its explosions, and the water for about an inch around it, effervesced much in the same way as a seidlitz powder. The effect of the vapour upon the human skin resembles that of some of the mineral acids. M. Dupont, having taken a nest consisting of more than a thousand individuals, near Tripoli, had his hands stained quite black in consequence of their contact with the crepitating fluid. It is said to be neither acid, nor alkaline, and to be soluble both in water and alcohol. It retains its explosive properties for some time after the death of the insect, and explosions may be produced at pleasure, until the secreting organs become rigid by pressing on the abdomen. The bombardier is able to discharge its weapon seven or eight times, or more.

Our little artillerymen have also the property, by bending the joints of the abdomen, of direct-

ing their discharges at any desired object. After a time, their ammunition appears exhausted, and they require repose to renew their stock. A singular account is related by Mr. Westwood, as having been communicated to him by the celebrated traveller, Burchell. "While resting for the night on the banks of one of the large South American rivers, he went out with a lantern to make an astronomical observation, accompanied by one of his black servant-boys; and, as they were proceeding, their attention was directed to numerous beetles running about upon the shore, which, when captured, proved to be a large species of *Brachinus*. On being seized, they immediately began to play off their artillery, burning and staining the flesh to such a degree that only a few specimens could be captured with the naked hand; leaving a mark which remained for a considerable time. Upon observing the whitish vapour by which the explosions were accompanied, the Negro exclaimed in his broken English, with evident suspicion, "Ah! massa, they make smoke."

In a communication to the Journal of the Asiatic Society of Bengal, a similar apparatus to that of the

bombardier is described, possessed by a family of Coleopterous insects—the *Paussidæ*, exclusively the inhabitants of tropical Africa, and Asia, and parts of Australia. On these insects being seized, they emit a very acrid fluid, accompanied by an explosion which is attended with a very strong scent. This explosion produced a distinct sensation of heat, and its odour was that of nitric acid. The skin of the hand was stained dark brown by the vapour, and so deep were the stains, as to remain eighteen days in one hand. No doubt, such a creature proves a formidable antagonist to its enemies.

Our fields and gardens are not unfrequently the scenes for the single combats of spiders. Very frequently, a spider when placed in the net of another, will fly with its utmost speed, as if conscious of the danger of drawing out the lawful owner from his silken den. But they fight on the ground, when once engaged in the battle, with infinite ferocity. Being by nature of a sanguinary and cruel disposition, their duels, as may be imagined, are fierce and sanguinary too. They bite each other furiously with their strong jaws, and the issue of the conflict is some-

times in the death of both the combatants. Sometimes, sad to say, these duels are between a male and female spider. "I saw one day," says De Geer, "a male spider gently approaching its mate, who was quietly placed in the middle of her web, and taking great care not to come incautiously into her presence, or to approach too near, retiring several times as if frightened. Coming at length a little nearer, in an instant the unhappy intruder was seized by the cruel female, held fast between her jaws, and after being enveloped in its winding sheet of web, it was devoured by her. I acknowledge," says this tender-hearted entomologist, "that this spectacle filled me with horror and indignation." If a spider accidentally falls into the net of another, the proprietor of the net instantly pounces upon it, and destroys it. The attacked insect, fighting on the defensive, struggles to the utmost to tear itself from the jaws of its enemy, and often with success, although it frequently dies afterwards of the wounds it has received. The intruder, if larger and stronger than the spider into whose net it has fallen, never pursues the retreating owner, nor occupies as its own the deserted web.

They do not appear to like occupying another's home; feeling, probably, that they are in a strange place. Both parties therefore fly from each other with mutual terror and equal precipitation.

Sometimes a duel of a sanguinary character will ensue between a spider and a scorpion; of all insects, perhaps the best matched for ferocity, although scarcely equally armed. The sting of the latter is a far more formidable weapon than the jaws of the former, added to which the scorpion has a powerful pair of claws. Frequently a very little scorpion will attack a very large spider. Seizing it by one of its claws, or by both, it, after a short struggle, thrusts its venomous dart into the spider's body, the latter almost immediately dies, and the murderous duellist does not leave the field until it has entirely devoured the corpse of its miserable opponent,—a terrible reprisal for the fly-murders committed all its lifetime by the latter.

In the hot summer days, in the month of June, the naturalist will often be the witness of a duel between two pretty insects (*Clytus arcuatus*), which love to inhabit the chinks in the

bark of oak-trees, whither they fly for concealment on the approach of an intruder. "They are to be found," says Mr. Bond, in the "Entomological Magazine," "on the trunks of felled oak-trees in Hainault Forest in June." These insects appear in the full sunbeam as happy as they can be, running over the surface of the bark, occasionally stopping, and by the motion of their thorax producing a little creaking noise of gladness, until a male of the same species appears on the scene. This excites all their angry passions, and a duel is sure to follow. "I have often watched their combats," says Mr. Bond: "they stand at a little distance from each other, like bulls, then rush together with great violence, each aiming at the antennæ and legs of its opponent. On these occasions, there is usually a female standing by, coolly looking on." It does not appear that these duels end in any more melancholy results than just the loss of parts of the antennæ and legs of the combatants.

The Mantids, or praying insects, or Soothsayers are famous for their duelling propensities. Rösel the celebrated entomologist, being de-

sirous of investigating their habits, inclosed the young mantes in a glass vessel, evidently greatly to their annoyance; the insects using every possible effort to relieve themselves from confinement. In running around the prison of glass, Rösel often saw them, on meeting with their companions, fight one another to the death; the victor even at its tender age always devouring the remains of its murdered brother. The naturalist, ignorant of the ferocity of these creatures, imagined they must have been impelled to be guilty of this crime by the cravings of hunger; had compassion on them, and introduced a few ants into their den, thinking that the mantes would be satisfied with them for food, and would cease their murderous combats. Immediately he perceived his error, for the ferocious mantes fled before the ants like sheep before wolves; and the ants actually fell upon, and destroyed the mantes. The ants being removed, some flies were introduced, and some Aphides, the latter they greedily slew and devoured. Nevertheless, although they had an abundant supply of nourishment, they never ceased to attack, kill, and eat each other when

they met; so that nearly the whole of the original stock was lost.

As if to render the mantis more completely identical in its character as a duellist with those of our own species, to whom the epithets applied to the poor insect—irascible, cruel, and cowardly—are equally applicable, it is furnished with a sword, or rather with two. The forelegs of this insect are sharp, flattened, sabre-like appendages, and are wielded with such effect by the insects in their combats as to inflict severe wounds upon each other: their demeanour in a hostile encounter is highly remarkable. No sooner do they espy each other, than both insects for a time remain stiff and motionless, steadily gazing at each other; their necks are stretched out to the full extent, the wings tremble, expand, and flutter, while the whole frame quivers with anger. Suddenly they rush upon each other with the utmost fury, and hew at one another with their swords, like a couple of infuriated hussars. The duel continues with much ferocity and great loss on both sides, until at length the weakest perishes, and its trembling limbs are devoured by its victorious opponent.

The duelling disposition of these fierce insects is turned to an evil purpose in China. Taking a savage pleasure in beholding their combats they collect them and keep them in little bamboo cages for fighting, and in the summer months boys are to be seen hawking about the streets their cages of imprisoned warriors. They make the poor insects fight by putting them into a basin, and irritating them with a straw. Little requiring any incentive to duelling, the insects almost immediately fall upon each other, and begin slashing at each other with their forelegs, or biting each other with such severity, as seldom to quit their hold without bringing away at the same time a limb of their antagonist. Great sums of money are sometimes staked upon the issue of these duels by the wealthy, and the vulgar gamble in a similar manner for trifling coins. A wealthy Chinese will sometimes consider a victorious mantis, the destroyer of many of its fellows, worth several hundred dollars; so says Mr. Langdon in the illustrated catalogue of the Chinese Collection.

M. Du Hamel has given a singular account of the duels of the mason bees, which deserves to be extracted, and to form one of the illus-

trations of the subject of this chapter. The mason bee constructs a pretty and ingenious dwelling of sand and particles of stone cemented together. Here she deposits her egg, and food for the future larva. But while engaged in her duties of collecting the spoils of the flowers for the latter purpose, one of her own kind, finding a comfortable cell all finished to hand or nearly so, takes illegal possession of the same. The rightful owner returns home; to her surprise and excessive indignation she is denied admittance at her own door by the impudent appearance of the intruder from within, who seems as if it would inquire of her what she wanted there? Resolved not to be turned out of the abode her own skill has constructed, the rightful owner lays down its burden, whatever it be, and offers battle to the trespasser. The latter, nothing loth, steps out of the cell, and both insects fly into the air, where the duel begins. Their combat is now conducted with some skill, and they exhibit various stratagems in trying to get the vantage position over their antagonist. They rush at each other with the utmost fury;* not

* See Frontispiece to this Chapter.

unfrequently they dash together head to head, like bulls. At other times they strike sideways or from above at each other's bodies, and their blows are sometimes so violent that they fall together to the ground. While in the air their evolutions are most singular, and their manœuvres highly curious; but when on the ground, their whole efforts are exhausted in the attempt to thrust each other with their weapons. The issue of this duel is sometimes in the death, but more frequently in the discomfiture of one or other of the combatants, upon which the victor or survivor takes possession of the nest.

Hornets, notorious for their murderous doings among flies, are sometimes engaged in the most desperate duels. "The hornet," observes the author of "The Journal of a Naturalist," "is a very pugnacious animal. They will fight desperately with each other at times, when they meet in pursuit of prey, biting each other's body, and trying to get their mandibles under the head of their opponents, to snip it off. I one day confined, under a glass, two of these creatures, which had been fighting. One had evidently the mastery; but both had been so injured in the

contest, that they soon died; and it is most probable, that they fall victims to each other's voracity, in the cold, damp season, that usually terminates the autumn of our year."

The formidable dragon-fly, the enemy of almost every insect on the wing, from the tiny to the great, sometimes engages in mortal conflict with one of its own kind. "One day, last July," writes a correspondent in the "Magazine of Natural History," "walking down West End Lane, Kilburn, I observed a pair of the *Æshna varia* sporting over the surface of a pond. While admiring the elegance of their evolutions, and the brightness of their colours shining in the sun, another male made its appearance. This obtruder upon their mutual happiness, *sans cérémonie*, began chasing the female; but upon this the real mate immediately pursued his rival, and a very pleasing sight took place. They were now actually in a hostile engagement, flying at each other by repeated darts; the shining armour of the combatants, and their wings rustling like tinsel, adding not a little to the scene. This lasted for about ten minutes, when at length one fell into the water, apparently from ex-

haustion: and now was exhibited the sagacity of the conqueror, who pounced upon his back, as he floated on the surface, and remained so for a little while. During the whole of this exhibition the female continued to skim about in pursuit of prey, and seemingly not taking the least interest in the affray. She was soon joined by her companion, who had left his victim still struggling on the surface, but without the power to rise, as he had deprived him of his wings. Can this be called instinct? What could human reason have dictated to operate more effectually?"

The Ichneumons, which, though they attack differently, are also arch destroyers of insects, sometimes, as the following extract from a paper of Mr. Westwood's will show, fight over the body of their victim:—"On May 13th, I bred a male and female, both of which ate sugar; but in the evening the female began to attack some rolled-up caterpillars. On May 14th she killed a caterpillar, but could not get it to come previously out of the leaf; she, therefore, gnawed a hole through the leaf, keeping her ovipositor (the organ for the deposition of the insect's eggs) in the caterpillar,

and gnawing round it as a guide. She then withdrew her ovipositor, and began eating the caterpillar: when she had eaten as much as was under the hole, she used her tail as a fork, to bring her dinner within reach! One thrust of the ovipositor in the head of a larva generally deprives that part of motion; caterpillars above half an inch in length require more killing; the ichneumons, however, killed some an inch long. In one instance I observed an ichneumon drive out a caterpillar from the folds of a leaf; when another ichneumon thrust at it, and drove it to the edge of the glass, where, after a stab or two, it became motionless. She then began eating it, but the former, thinking she deserved part, wanted also to eat; this, however, the latter would not allow, and drove her away. Nothing daunted, she returned to the charge, and unsheathing her ovipositor, seemed determined to maintain her rights; whereupon the other, recollecting, perhaps, the fable of the bear and the lion, allowed her to have a share. They ate together amicably, until the caterpillar was too small for two; when they fought again, one of them seizing it in her mouth, whilst the other

went in search of more, but, finding none, she jumped suddenly on her companion, and, upsetting her, seized the skin of the caterpillar, now not worth contending for. They are very pugnacious, fighting with their wings and legs; and frequently lose a dinner (an unhappy caterpillar) which makes the best of its way off. They, however, spent a considerable time every day at the sugar."

Captain J. Hutton describes a ferocious spider met with in India, to whose habits reference will be made on another occasion, as sometimes meeting in deadly combat with one of its own species. When two of them are confined in a vessel together, both endeavour to make their escape, as if conscious of their mutual danger. If in their efforts to get away they are brought into contact, the one instantly seizes the other and devours him, the victim making no struggle whatever. But if they meet face to face, both enter into a wrestling match for life or death. And now comes a scene of trial of prowess, not less fierce than those of armed knights in tournament, but without the surrounding crowd of spectators.

The furious insects knowing each the other's

redoubtable strength and force of arms, plant their feet firmly on the ground, slightly raise their bodies, and hold out the two pairs of palpi in front to ward off the attack. In this attitude they advance and retire according as either gains a slight advantage, endeavouring to throw each other to one side, so as to expose some vulnerable part, or form an opening for attack. Long time the skirmishing continues, and for neither side has fortune yet declared the victory. The ground trembles under their strugglings, and both combatants appear so well versed in the science of defence and attack, and so equally matched in strength and cunning, that the issue seems as remote as ever. Suddenly, his footing perhaps loosened by some inequality of the ground, one of the duellists is thrust a little on one side. The other instantly perceives his vantage, and rushing in seizes upon his adversary behind the thorax. A spirit of fatalism now takes possession of the latter. In despair he gives up all strugglings, feeling perhaps that all is vain now, his prostrate carcase pierced with gaping wounds lies in the dust, and above it stands his victorious foe, whose ruthless jaws cease not to

mangle the quivering remains, until all are devoured.

These scenes of conflict and deeds of death are to us at least painful to think on, and they exhibit a sad view of the propensities of the animal tribes. Yet, undoubtedly, these very propensities accomplish well that part of the plan of Nature, for which they are permitted to develop themselves. In the wars of Nature some wise and really good object is kept in view by its Great Author. The excessive multiplication of one species might entail misery and death upon a far greater number of creatures, than are represented by the slain on the battle-field—or that of single combat.



CHAPTER VI.

INSECT GAMBOLS.

What other spirit can it be that prompts
The gilded summer flies to mix and weave
Their sports together in the solar beam,
Or, in the gloom and twilight, hum their joy?

SURELY, we must answer, none other than the participation of delight, to which even insects are not strangers. Ours were a gloomy insect-history if only filled with deeds of battle and of death. But it is not so. Strange as it may sound, we shall discover even in insects abundant evidences that the great God of creation has not been unmindful of their happiness, and that, while He has given to every one his appointed task, He has graciously combined with it the capacity and opportunity for relaxation, and, whether to the laborious bee or toiling ant, has bestowed, out of His love, a little cup of happiness to sweeten the labours



CHAPTER VI.—INSECT GAMBOLS.

of its lifetime. It must be confessed, it is extremely difficult for us to comprehend the precise nature of an insect's sensations, and we are very apt to interpret their actions and behaviour by a too strict comparison with our own. But there are certain points so clearly exhibited in insect manners, and so strictly analogous to the proceedings of other creatures and of ourselves, that we are fully justified, in these cases, to call these features of their conduct by the same terms that we apply to those of other animals, and of our own. When we see a kitten at sport, giddily racing hither and thither for no other apparent object than its own amusement; or when we see the gambols of a lamb around its mother, we are at no loss for words to express our thoughts as to its feelings; we have a sort of natural perception that these movements are those of a happy creature delighting in the exercise of its new-born powers. We must not then refuse the same language in its application to the behaviour of insects when we see them do likewise, and we are bound to acknowledge the existence and the reality of insect gambols.

If we longer doubt on this subject, let us

betake ourselves to the brook, and make the acquaintance of the merriest and most agile of its insect inhabitants—the *Gyrinus natator*. For this purpose a mild sunshiny day in April must be selected for the visit, or it may fail of its end.* Let us hear, however, the pleasant words of Mr. Knapp, upon the conduct of this little creature. “Every schoolboy who has angled for minnows in the brook, is well acquainted with this merry swimmer in his shining black jacket. Retiring in the autumn, and reposing all the winter in the mud at the bottom of the pond, it awakens in the spring, rises to the surface, and commences its summer sports. They associate in small parties of ten, or a dozen, near the bank, where some little projection forms a bay, or renders the water particularly tranquil; and here they will circle round each other without contention, each in his sphere, and with no apparent object, from morning until night, with great sprightliness and animation; and so lightly do they move on the fluid, as to form only some faint and transient circles on its surface. Very fond of society, we seldom see

* See Frontispiece to this Chapter.

them alone; or if parted by accident, they soon rejoin their busy companions. One pool commonly affords space for the amusement of several parties; yet they do not unite or contend, but perform their cheerful circlings in separate family associations. If we interfere with their merri-ment, they seem greatly alarmed, disperse or dive to the bottom, where their fears shortly subside, as we soon again see our little merry friends gambolling as before."

Defended behind by a thick hedge, and in front by a ditch full of water, the one forming an impenetrable barrier, the other an impass-able moat, Huber found a colony of fallow ants whose proceedings were highly remarkable. Safe from the attacks of their foes, and pre-serving an abundance of food, these ants were as happy as insects could be; the whole colony was remarkable for its harmony and good order. The insects of which it was composed, were distinguished for their kindness and attention to one another, and the whole community en-joyed a state of peaceful prosperity and increase, rarely united in the history of similar colonies. The ants being thus free from those distracting

cares which vexed their less fortunate neighbours, had leisure and apparently inclination for amusements, and those of a very singular kind.

Upon careful observation of this happy family, one sunshiny day, a large number having been tempted out by the brightness and serenity of the weather, they were found to be passing away their time, not in work, but in play; their chief amusements were gymnastic exercises, and hide and seek. Two ants would approach one another, would gently pat each other on the cheek, and then resting themselves upon their hind legs, would wrestle with each other. They embraced, struggled with, and overthrew each other with the greatest possible good-will, never using any violence in their actions, nor discharging their venom as in their more serious affrays. Some one, more playful than the rest, would overturn three or four individuals, one after another; and, getting finally an overthrow itself, would resume a more steady behaviour for a time! Taking up a position on each side of a blade of grass, some would be found gambolling with each other, by dodging to and fro, now attacking, now retreating, now pur-

suing, now flying. After a vigorous somerset given to a wrestler, one would run away, and hide itself in one of the galleries. Sometimes they amuse themselves in a still more singular way, by riding upon one another's backs! M. Bonnet says he found a nest of ants in the head of a teasle, enjoying the full sun, and amusing themselves with carrying each other on their backs; the rider holding with its mandibles, the neck of its horse and embracing it most closely with its legs! * Sometimes also they snatch one another up, and, after carrying the captive a little way in the air, they drop it and run away.

Among the illustrations of insect gambols presented to us by Entomology, we must not forget the *dances* of insects. The beautiful, but short-lived creatures, so familiar to us in summer, the Ephemerae, come together in troops, to enjoy this sportive exercise. A charming account of a dance of this kind, is related by one of the authors of the "Introduction to Entomology." "In the beginning of September, for two successive years, I was so fortunate as to

* M. Bonnet's assertion is somewhat questionable.

witness a spectacle of this kind, which afforded me a more sublime gratification than any work or exhibition of art has power to communicate. The first was in 1811, taking an evening walk near my house; when the sun, declining fast towards the horizon, shone forth without a cloud, the whole atmosphere over and near the stream swarmed with infinite myriads of *Ephemeræ*, and little gnats of the genus *Chironomus*, which in the sunbeam appeared as numerous and more lucid than the drops of rain, as if the heavens were showering down brilliant gems. Afterwards in the following year, a little before sunset, I was enjoying a stroll with a friend at a greater distance from the river, when, in a field by the road-side, the same pleasing scene was renewed, but in a style of still greater magnificence; for, from some cause in the atmosphere the insects at a distance looked much larger than they really were. The choral dances consisted principally of *Ephemeræ*, but there were also some of the *Chironomi*; the former, however, being the most conspicuous, attracted our chief attention: alternately rising and falling in the full beam, they appeared so transparent

and glorious, that they scarcely resembled anything material; they reminded us of angels and glorified spirits, drinking life and joy in the effulgence of the Divine favour. The bard of Twickenham, from the terms in which his beautiful description of his sylphs is conceived in the ‘Rape of the Lock,’ seems to have witnessed the pleasing scene here described:—

‘Some to the sun their insect wings unfold,
Waft in the breeze, or sink in clouds of gold;
Transparent forms, too fine for mortal sight,
Their fluid bodies half dissolved in light:
Some to the wind their airy garments flew,
Their glittering textures of the filmy dew,
Dipt in the richest tincture of the skies,
Where light disports in ever-mingling dyes;
While every beam new transient colours flings,
Colours that change whene’er they wave their wings.’”

In the “Annals of Natural History,” Mr. Patterson has communicated some interesting particulars of an infinite host of insects sporting in the air, and observed by himself and others at Belfast.

Wherever there were trees, columns of insects were seen, and attracted the notice of even the most incurious. They began to appear a little

before seven o'clock, and diminished in numbers as the light decreased, so that by half past nine few were visible. The insects appeared in columns above the trees, the shade of colour varying according to the greater or less density of the mass from that of light vapour to black smoke, the columns not only differing in this respect from each other, but each column being frequently different in different parts. They might have been mistaken for dark smoke wreaths but for their general uniformity of breadth, and for a graceful and easy undulation, similar to that of the tail of a boy's kite when at some height, and tolerably steady. The individual insects flew about in each column in a confused and whirling multitude, without presenting in their mazy dance, any of those regular figures which gnats frequently exhibit over pools of water. The motion of their wings filled the air with a peculiar and not unmelodious humming noise, like the distant sound of the machinery of a spinning-mill, but more varied. The columns rose perpendicularly to the height of from thirty to sixty feet, and in some instances to the height of eighty feet. They were equally abundant

over trees of every kind, as ash, beech, birch, poplar, &c., and so numerous were these distinct columns, that so many as from two hundred to three hundred were visible at the same time. As each column was every instant undergoing a change in density of colour, diameter, elevation, or form, the phenomenon was one of exceeding interest, especially as connected with the living myriads, which in these aërial gambols gave expression of their enjoyment.

“I have been unable,” observes Mr. Patterson, “to define the precise range in which these singular assemblages of insects appeared. About Belfast they were everywhere abundant over trees. At the residence of one gentleman, about a mile to the north of the town, they came forth in myriads; and when the noise of their wings first attracted his attention, he for a moment supposed it to be the sound produced by letting off the steam from a steam vessel at a distance. By a lady on the evening of the 11th, and by another on the evening of the 13th, it was mistaken for the sound of something boiling, and one of them hastened from the hall door into the house to see that her servant was not neglecting some culinary

matter then in progress. At Colin Glen, about four miles west of Belfast, they were observed on the 12th. On the evening of the 11th, the person who has the care of the Friar's-bush burial-ground, adjoining the Botanic garden, thought the dark smoky looking columns which he saw were caused by something being burned in the garden, and ascended the highest part of the ground to ascertain if such were the case."

Another gentleman, to whom this beautiful phenomenon was also visible, writes as follows upon the appearance as presented to his notice:—"At eight o'clock in the evening, my attention was arrested by what appeared to be several columns of black smoke, rising into the air above the trees to a great height, 'like the masts of some tall ammiral.' Looking upon them as smoke, I could not understand why a portion of one should occasionally vibrate, or as it were break down until it would touch a neighbouring column to the east of it, while another would play a similar part towards a column on the west. The whole appearance seemed to indicate an extraordinary state of the atmosphere, though I could not perceive the gentlest zephyrs blow-

ing different ways, so near each other, and about the same time. On approaching nearer, however, the phenomenon was explained, and proved to arise from columns of a large species of midge instead of smoke. The trees along the west side of Donegal Square (Belfast) are deciduous and chiefly elms, *Ulmus montana*, about forty-five feet in height, forming a continuous row; and the summit of almost every tree seemed to be emitting smoke, sometimes in two or three distinct columns. The insects presented themselves in masses of every form: the most remarkable of which was the tall mast-like column. One cloud of them appeared above the middle of the spacious street, where numbers of persons were assembled, gazing and wondering at the singular spectacle. There were as usual several swifts (*Cypselus apus*) flying about the square, and I particularly remarked, that although they occasionally passed near the masses of insects, they never once swept through any congregated party of them. For some time past the weather has been remarkably fine, dry, and warm as was this day." This interesting spectacle was witnessed on the 9th of June, 1842.

In Dr. Forster's "Encyclopædia of Natural Phenomena," part i. containing the prognostics of the weather, (p. 68,) there is the following account of a remarkable vapour that was seen to ascend from an elm tree at Clapton:—"On Sunday evening, August 11, 1805, I observed a very unusual exhalation from an elm tree at Clapton, in the parish of Hackney, the particulars of which are as follow: between six and seven o'clock in the afternoon, while sitting at tea, the sky being clear and the weather warm, and the wind south-east, we observed a column of darkish vapour, which appeared to arise from the top of an elm tree at some distance: it looked about two or three feet high. After it had continued a few seconds, it disappeared; and, after a few seconds more, reappeared, and continued in this manner, on and off, for nearly half an hour, when it became too dark to distinguish it any longer. More particulars may be found in the 'Gentleman's Magazine' for 1805, p. 816." "Having more than once witnessed a similar appearance," observes a writer in the 'Magazine of Natural History,' "and probably under circumstances more favourable than those

under which the observer saw the one in question, which he has described with such minute and laudable fidelity, I have no hesitation in stating that this was not a vapour, but a vast assemblage of gnats, which, when seen at a distance, very much resembles thin smoke or vapour, and the disappearance and re-appearance were obviously caused by the wind's gently wafting them (or by their own voluntary dancing) 'on and off' the spot where they were enjoying their aërial gambols. The first time I witnessed an appearance of this sort was on a still summer's evening in July; and, until I approached the spot, I felt sure it was vapour or thin smoke, which the stillness of the evening had rendered nearly stationary; but a close examination (which I was able to make) disclosed the fact. Kirby and Spence, in their 'Entomology,' vol. i. p. 113, mention a similar appearance over the Cathedral at Salisbury; and so strongly were the inhabitants impressed with the idea that it was smoke, that fears were entertained for the safety of that celebrated structure. An appearance of this description was in Spenser's mind when he wrote the familiar stanza, beginning,

‘ As when a swarme of gnats at eventide,
Out of the fennes of Allan doe arise,
Their murnuring small trompets sounden wide ;
Whiles in the aire their clust’ring army flies,
That as a cloud doth seeme to dim the skies.’”

The remarkable hummings in the air occasionally noticed in fine warm weather in the country, is probably often connected with the sporting gambols of insect multitudes. On a hot day in September, and on an elevated woody hill, called Alderley Edge, in the vicinity of Manchester, the writer observed a phenomenon allied to this. A pretty loud rushing, musical sound was heard in the air, rising and falling in soft cadences, the origin of which appeared obscure. It was at length discovered to arise from the flight of thousands of insects now darting in swarms into the still air, now resting again on the trees hard by. White of Selborne mentions an audible humming in the air, occurring occasionally on the elevated parts of the Sussex Downs, for which he was unable to account. These sounds, heard by ignorant and superstitious persons, have often given rise to pretty but foolish fables, on the music of the wilds. The poet

Thomson notices this sound with his usual elegance :—

“Nor undelightful is the ceaseless hum,
To him who muses through the woods at noon ;
Or dreamy shepherd, as he lies reclined,
—— beneath the floating shade
Of willows grey.”

The sound is often heard without insects being actually within sight ; yet it is frequently so loud that any one would suppose that a large swarm of bees was in motion, and playing about over his head. Nevertheless, in the great majority of cases, it is undoubtedly produced by insects, and, as Mr. Rennie has observed, high overhead, where the humming is heard, a troop of swallows may be seen actively hawking about. In the Brazilian forests the sound of insects produces an extraordinary humming noise. Mr. Knapp speaks of this pleasant country sound in this wise :—“That purely rural, little noticed, and indeed local occurrence, called by country people ‘humming in the air,’ is annually heard in one or two fields near my dwelling. About the middle of the day, perhaps from twelve o’clock till two, on a few calm sultry days in July, we

occasionally hear, when in particular places, the humming of apparently a large swarm of bees. It is generally in some spacious open spot, that this murmuring first attracts our attention. As we move onward the sound becomes fainter, and, by degrees, is no longer audible. That this sound proceeds from a collection of bees, or some such insects high in the air, there can be no doubt; yet the musicians are invisible. At these times a solitary insect or so may be observed here and there occupied in its usual employ; but this straggler takes no part in our aërial orchestra." It is very probable, however, particularly when this sound is heard, in such circumstances, and of such a character, as described by the last author, that it is rather to be attributed to vibrations produced in the air by the heated surface of the ground, than to unseen insects.

Mr. Gosse, in an article in the "Annals of Natural History," on the insects of Jamaica, gives us an account of the sports of a little butterfly:—"About the end of March this little sombre insect occurs, playing about the flowering plants and fruit-trees of the pastures,

especially in the lowlands. In Bluefields pasture I have observed it affect the bushes of *Cleome pentaphylla*, whose elegant long stamened blossoms probably attract it, though it does not rest much on them, but pursues its game of aërial play with its fellows in incessant and unwearied pertinacity. Half a dozen or more whirl about each other in the air with a rapidity of contortion that the eye of the observer vainly attempts to follow. Often two or three will begin to play around an orange-tree, and, in a few seconds, others, which we had not seen before, coming from no one knows where, suddenly join in the gambols, and thus the little group increases to eight or ten, which, after a while, separate and disperse as invisibly as they came. Their small size, and great rapidity of motion, doubtless helps to produce this effect. They delight in the full beams of the burning sun; the hottest part of the day is the season of their greatest activity, and even the shadow of a passing cloud will spoil their play."

Some insects, like some amongst ourselves, prefer the hours of evening for their amusement, and gambol in the silent air of night. Among these

none is more remarkable than the ghost moth. In the warm evening hours of May, under some hedge in a mead, or in some luxuriant low-lying pasture, our gamboller may be seen commencing his evening dance. Without a partner, it is to be seen flying irregularly to and fro, now rising, now falling, now dancing in this, now in that direction, in a space not exceeding a few yards in circumference. Until twilight deepens into night this unwearied gamboller will be seen dancing, apparently purely for his own amusement. But, in reality, not so. "This procedure," writes Mr. Knapp, "is not the meaningless vagary of the hour, but a frolicsome dance, the wooing of its mate, which lies concealed in the herbage, over which it sports." Alas! sometimes in the midst of its innocent pastime a hungry bat whirrs past, seizes on the wretched flutterer, and, in a moment, its life and sports are together ended. The insect has received its ominous title, the ghost, from its always appearing when the shades of evening fall over the landscape, the same hour being, in the opinion of the learned in such matters, the most appropriate time for the appearance of spectres, which, strangely enough,

never are seen when most objects are best seen—that is, in the full daylight!

A correspondent of the "Entomological Magazine," describes a very curious fact about humble bees, which fairly deserves a place among our records of Insect Gambols. He says, that when they get on a sunflower they feast so bountifully upon the honey, as to become almost as if intoxicated or stupified. They become very cross and sleepy. If you touch one, he leans on one side and lifts the opposite legs into the air, as if he were about to fight, and plays divers other antics, until at length he sidles, staggers, rolls and falls to the ground, and there lies on his back, until the effects of his feasting are at an end. It is probable that the honey secreted by the sunflower contains some stimulant or narcotic property which produces these ludicrous effects upon the insect feasting too largely upon it.

Perhaps as singular an instance as any is an account of the playfulness of a stag-beetle, given by Mr. Waterhouse, before the Entomological Society. He stated that he had kept alive a male specimen of that insect for several weeks,

his principal object being to ascertain the use of the great mandibles and other organs. From his observations it appears evident that the formidable mandibles are employed in the harmless operation of wounding the bark of trees, in order to cause the sap to flow, on which the insects feed. The specimen in question was kept alive by feeding it with sugar and water; it had also a *penchant* for the juice of raspberries and other fruits. It frequently bit Mr. Waterhouse's finger, but without producing any injury. During its captivity it became exceedingly tractable, and even frolicsome. Being well-fed, and so without care, the poor insect would show its playful spirit by tossing about a ball of cotton with its mandibles, and holding it up in the air, just as a kitten does when provided with a similar plaything.

We need not leave our sitting-room to witness the gambols of insects, when we can watch those of the humble house-fly. This little creature seems to spend a large portion of its existence in nothing but pleasure. Having quaffed its fill from some sugary treasure, left in its way, it seeks the upper air of our apartments, and

there commences its curious dances. To that mind which does not despise the objects of nature because they are small or familiar, there is much amusement derivable from the observation of the dance of a fly! How pleased appears this tiny creature with the splendid paper palace, so curiously cut, and magnificently adorned! Our housewives, anxious to preserve their furniture from the stains of the excrement of this insect, are well aware that it delights in a paper bauble, and around it will be seen congregated a majority of the flies contained in the room. Amusing it is to behold one after another of these little beings dart down into the air, sail about in a course of a figure-of-eight description, now and then meeting a companion, and playfully tussling with him, and then resuming its mazy movements again. When wearied of its pastime it flies back again to its palace, where it may be seen pluming itself, and preparing again for flight. So pleasantly and happily passes the little hour of its existence away, and it returns to the void from whence it sprang.

The subject of this chapter is pleasant—

doubly pleasant after that of the two preceding ones. While we have seen insects fighting each other to the death — insects whose hand, so to speak, was against every insect's, while war-like armies have been paraded before our eyes, and their deeds of prowess narrated in our ears, it is refreshing to read of insect gambols too. Insect life is not all battle, tumult, and distress. God has made them happy creatures, and they, in their humble manner, testify to their delight, and to His love and goodness, in their pastimes and gambollings. Let it make us to wonder and adore, as we think of the great Almighty Being, who upholds the universe of His creation by the word of His power, humbling Himself to care for, and to give joy and gladness even to an insect.



ANT HILL

CHAPTER VII.—LANGUAGE OF INSECTS.

CHAPTER VII.

LANGUAGE OF INSECTS.

THIS will appear the most surprising part of all in the history of insects. Not a few, ignorant of the facts of the case, will strenuously deny to our humble friends the power of language; and those who may not deny the possibility of the existence of such a faculty, will not easily give their due weight to the interesting and remarkable facts which entomologists have collected on this subject. But why should we, from a foolish prejudice, deny to insects the existence of a means of intercommunication? Is it that they have no voice, and have, therefore, no language? This would be a very short-sighted view of matters. Insects do not possess a tongue like ours, but are we, therefore, to believe that they have no taste, nor organs adapted to convey the sensations of that faculty? Neither have insects

ears, nor a nose like ours. Yet they do undoubtedly possess both the senses of hearing, and of smelling.* Because, therefore, these little beings are not formed like ourselves, we have no just grounds for actually believing them to be totally devoid of senses, or of faculties in some humble degree analogous to the exalted powers bestowed by God on man himself. This point has been much disputed by naturalists, apparently violently, unwilling to extend to insects any degree of the powers of conversation, possessed, without a doubt, by many other animals. It is necessary, however, that we should as a precautionary measure, guard the reader from the supposition that the language of insects, if it exists, is any such noble faculty as that possessed by man. Its extent is doubtless limited, and its expressions are feeble and obscure. But they accomplish the end in view, and appear to afford to many members of the insect world a useful, and indeed, in some cases, indispensable means of communicating and receiving information. In entering upon this subject, however, the language of Huber may well be adopted. "If

* See Life of Insect, Part I.

insects have a language, I cannot give too many proofs of it; if I labour under an error, the following facts, in whatever manner they may be explained, will plead my excuse."

The organs by which this language is conveyed, expressed, and received, are without question, in many instances, the antennæ, upon the varied use of which we have before written in the first part of this work. These singular appendages of the head are highly organised, and endowed with nerves by which any impressions made upon them are conveyed to the nervous centres of the insect. The manner in which these organs are employed, is various. But it consists, to speak generally, in gently tapping the antennæ on some part of the body of other insects. What peculiar sensations are thus excited, it is impossible for us to conjecture. It is very evident, however, that a means of communication of intelligence actually exists in these manœuvres, as the creature tapped behaves just as if it had heard important news from the other.

It is difficult to imagine that insects could live in society, performing common works, and each occupied in duties, which, though confined

to the individual, are part of a general scheme, without some such means of informing one another of the requirements of their community, or of the existence of some accidental interference with its affairs. When we look at a party of bees about to emigrate, and find them neglecting their daily toils and engrossed with the preparations for departure, can it be doubted that the intelligence of the proposed undertaking has been communicated from one to the other, until the whole of the expedition party is made up? It has been already mentioned, that the evening before emigrating, a distinct noise is heard in the hive, called piping. Dr. Bevan says, "It is now ascertained beyond a doubt, that the sharp, clear notes, uniformly proceed from a princess that is at liberty, and that the notes which are uttered in a hoarse key, as uniformly proceed from one that is still imprisoned." While there remains some doubt upon the whole subject of "piping," it is still right to mention that it is considered by some to be a means of communication between the queen and the rest of her bee subjects. We need not imagine, with many who take this view of the question, that the queen

really treats her subjects to an harangue, or that they comprehend it as such. Without in the least pledging ourselves to the correctness of the following observation, even though it is one of the generally accurate Huber's, it is right to introduce it as an illustration of what some entomologists have considered to be a kind of language between the queen and her subjects. Modern students of the habits of bees, have not as yet succeeded in verifying Huber's statements. Speaking of the appearance of a new-born queen, he writes:—"The new queen occupied all our attention. When she approached the other royal cells, the bees on guard bit her, pulled her, and chased her away. Their irritation seemed to be greatly excited against her, and she enjoyed tranquillity only when at a considerable distance from these cells. This proceeding was frequently repeated throughout the day. She twice emitted a very distinct sound, standing while doing so, with her thorax against a comb, and her wings turned on her back, in motion, but without being unfolded or further opened. Whatever might be the cause of her assuming this attitude, the bees were affected by it; all hung down their heads, and

remained motionless. (?) The hive presented the same appearance on the following day. Twenty-three royal cells yet remained, assiduously guarded by a great many bees. When the queen approached, the guards became agitated, crowded her on all sides, bit, and commonly drove her away. Sometimes, when, in these circumstances, she emitted her sound, assuming the position just described, from that moment the bees became motionless." This language, if such it be, and if such it may be called, is not carried on by means of the antennæ. Although Huber's results have not been substantiated, there is nothing improbable in the mere fact that bees are influenced by this sound. We need not imagine it, with Butler, a royal oration, intended to excite the loyalty and the courage of her subjects, but since it appears certain that bees are affected by some sounds, there seems no difficulty in the belief that this sound is not without its effect upon them also. Be it as it may, Huber's observation deserves extracting.

There is little doubt, however, that the antennæ are the chief organs of communication among the bees. The effect of removing a queen

from the hive sufficiently manifests this. The queen is the very soul of the community, and her presence is considered essential to its safety by the bees themselves. If a hive is gently fumigated the bees are quickly put into a state of great agitation, and their first step is to run about and ascertain if the queen is safe. Her presence reassures them, and quiets their alarms. Sometimes the queen has been removed experimentally. The bees do not seem to be immediately aware of it. In an experiment of Mr. Dunbar's a period of eighteen hours elapsed before her loss was discovered. Frequently, however, she is missed long before this. After her removal, until the bees discover their loss, all the works are carried on with their usual earnestness and diligence. A few bees find that the queen is gone, and hurriedly traverse the hive bearing the sad intelligence with them. The news-carriers inform every bee they meet of this public calamity, and do so by curving the antennæ and slightly striking them. Those who are thus communicated with, immediately become agitated with the tidings and fly, spreading trouble and confusion through the streets of the city.

The disorder increases,—in the language of the poets, the tocsin of alarm resounds—all through the hive, and the excitement of the insects becomes wider and wider spread. Then are the workers seen neglecting their tasks, and running over the combs, rushing against each other and impetuously hurrying towards the outlets of the hive. A scene full of the wildest excitement prevails within, and the tumult is audible some distance from the hive. “Our Queen lost!” we can imagine every insect out of the eighteen thousand impressed with this distracting news; and for a time the whole colony is threatened with ruin. Confusion reigns triumphant; arts are stopped, the nursery is neglected, the young ask food in vain, and the whole proceedings of the city are revolutionized under their direful misfortune.

Outside, a similar state of agitation prevails. The air resounds with the humming of a thousand wings. Bees fly hither and thither, return and depart from the hive evidently at their wit’s end, and perhaps anticipating little short of the entire destruction of the community. This excited state of matters continues for some hours, seldom

longer than four or five ; order is then gradually restored. Each insect seems to have the consolation of feeling, that all their hubbub cannot restore the lost monarch to them again, and they unite to create a new one.

Can it be doubted that these insects communicate with each other? On what other grounds than that they have a language,—that is, a means of interchanging certain ideas, can we account first for their clamour on discovering the loss of their queen, and, secondly, for their mutual co-operation in the processes necessary for the creation of a new monarch? When we behold one insect in an excited state run to another which is quietly continuing its daily task, touch its antennæ, and then see the latter become filled with a similar excitement, and rushing hither and thither, to the neglect of the task it had until then been steadily occupied upon, what other conclusion can we draw, but that the first insect has *told* something to the second? Communication of an idea, or a sensation has taken place, and that communication is language—language not indeed audible to mortal ears, nor to be comprehended by a mortal mind, —nevertheless,

language adequate to the necessities of these minute beings, and heard, and understood by them.

The following account of an experiment instituted by Huber, will exhibit in perhaps an equally satisfactory manner the existence of the power of communication by means of the antennæ. In this case also, the queen is the subject of the conversation. "I divided," says Huber, "a hive into two portions by means of a grating, executing the operation with such expedition and delicacy that the smallest agitation was imperceptible, nor was a single bee injured. The bars of the grating admitted the free circulation of air, but were too close for the reciprocal passage of the bees. I did not know which half contained the queen, but the tumult and hurrying in one soon assured me she was in the other, where quietness and tranquillity prevailed." The bees might have heard, or smelt their queen, had the sense of hearing or smell been the means of communication of the intelligence of her presence; they could even have seen her, had sight been the sense which rendered her presence evident to them. Yet they acted in all respects as if

they had for ever lost her, even while she remained separated from them only by the distance of a quarter of an inch.

Now follows an experiment on this subject still more singular. A frame was removed from one of Huber's glass hives, and replaced by a box of the same dimensions covered within by a grating, which allowed the transmission of the antennæ, but was too small for the heads of the bees. Waiting until the queen appeared in the front of a comb in view, the frame was opened, and her insect majesty was taken from amidst her companions without exciting their alarm. She was immediately confined in the glass box destined to receive her; but that she might not suffer too much from a situation so different from what she had been accustomed to, some bees of the same hive were introduced along with her, from which she experienced the wonted attentions. Singularly enough, the distress commonly following the departure of a queen was not manifested on this occasion. Everything remained in order; the bees did not forsake their brood during a single moment; their labours were uninterrupted, nor was any attempt made to form royal cells,

or to make preparations for the creation of another queen. Thus it was evident that all the bees knew that they had no need to replace their sovereign, that she was not lost,—neither, when she was subsequently restored to them, did they treat her as a stranger but recognised her immediately.

Every one has heard the tale, which some call fable, about the Cœur de Lion, a lonely prisoner in a dungeon cell, and his faithful subject and harper, Blondel, recognizing his royal master, though immured in the prison; the tale goes that Blondel sang one stave of a favourite song of the King's, to which he replied in the next. But we have already seen that it is not by the sense of hearing that the bee can recognize her royal mistress in prison. Truly a beautiful and a curious spectacle was to be witnessed at the prison-grating. The queen stood close to it, with her antennæ passed through the bars. Outside her prison were multitudes of her affectionate subjects all engaged in inquiring after her safety, thrusting their antennæ through in every direction; while she, on her part, had enough to do in quieting her subjects

by conversing with them, by means of the same organs, and, assuring them of her perfect safety and health. There remained this exemplary monarch, holding a levee all day long,* replying to the interrogations of every fresh comer with the most unwearied condescension. Several of the more patriotic and loyal insects resolved to effect the escape of their royal mistress from prison; and attempted, but in vain, to pull her through to themselves, seizing her legs, and doing their utmost to drag her through the too narrow grating. Finding this an unsuccessful attempt, they contented themselves with paying her every mark of attention that respect and affection could dictate, and diligently fed the captive monarch, during the whole term of her imprisonment.

It appears fully certain that bees have a kind of watch-word or signal, by which they can communicate with each other in going from, and returning to their hives. If a strange bee attempts to enter, it is, as it were, challenged by the sentry on duty at the entrance; and,

* This scene is attempted, imperfectly, to be represented in the Frontispiece to this Chapter.

if unable to give the proper pass, is said to be instantly killed. It sometimes happens, however, that several hives have the same pass, and then their several members rob each other with impunity. In these cases it is said that the bees alter their signs, and the enemy is then detected, and instantly executed. In what these signs consist, is not known. Wasps are also in possession of a means of communicating with each other. They apprise their comrades of the place whence they fetch the materials of their nests, so that one set will always be found carrying one material, another always another.

Bees have been noticed to visit one another's dwellings, without any hostile or predatory intention, and in these visits, it is highly probable that a sort of insect conversation takes place. At any rate it appears impossible to explain the intercourse on any other grounds than that of friendship. A very remarkable instance of visiting, occurred to Mr. Golding, in March 1832. His boxes, though at some distance from each other, were marked No. 4, and 5, and both families were vigorous, the former possessing an old queen, the latter a young one. No. 4,

appeared to commence the visiting; which, in its progress, became reciprocal, and was amicable throughout; No. 5 was shut up the first night, and continued so for about a week, during which time, the bees of No. 4 gradually discontinued their attempts to gain admission, and did not renew them for another week. The weather during this period proved cold, but, on the 4th of April, a day or two previous to the setting in of fine weather, the visiting recommenced, was quite reciprocal, and was so rapid as to communicate considerable heat to the glass windows of both boxes. At No. 5, there was a great throng of visitors. Yet the bees did not let their mutual attentions lead them to neglect the duties of their respective hives. On the contrary, both hives increased rapidly in weight. Gradually, however, the insect friendship abated of its ardour, and at the end of a week they visited together no more. It is well that we can add they did not, as in a case before narrated, terminate their acquaintance by a furious battle.

Viewing the antennæ as the organs most importantly concerned in the language of bees,

it is curious to remark the effect produced by cutting these organs off. Huber cut off both the antennæ of a queen bee, and the result was most extraordinary. The poor insect seemed affected with delirium. She ran hither and thither about the hive, dropping her eggs at random, and evidently in a state of deep agitation. She was unable to direct her proboscis aright, in order to be fed with honey, and when she did so, it was plainly only by chance. She made several ineffectual attempts to quit the hive. Yet the bees, her subjects, did not remit any of their attentions to her, but they were received on her part with great indifference. Another queen was mutilated, and introduced into the hive. Under other circumstances, the first would have pounced upon her rival, and a combat unto death would have followed. Now it was quite different. The mutilated queens met without even recognising one another, and without the smallest indication of resentment. The bees did not apparently know which was the right queen, since she had lost the means of communication with them, so both were treated alike, and with the customary honours. But

on another queen, with both her antennæ un-mutilated, being introduced, the bees seemed immediately to perceive that she was not their own monarch, and they accordingly seized her, bit her, and kept her so close a prisoner, that she became almost suffocated.

The antennæ of a number of workers, and male bees were then amputated. The bees refused to ascend the combs, no longer shared in the common operations, and generally remained below, where a little light was admitted from the entrance, which seemed to be their sole attraction. It appeared as if they felt that they could now no longer occupy their post in the daily business of the hive, and the insects seemed in a sort of half-witted condition. Mutilation of only one of the antennæ produced no such effects, the bees going on with their labours as usual.

These facts are interesting and important. But it is extremely difficult to assign any single function to organs of such complicated uses as the antennæ. That they are organs of exploration, and of receiving impressions from the world without, of various kinds, can scarcely

be questioned; and that they are also a means of intercommunication among certain insects, appears to be highly probable, if not actually proved by the facts already detailed.

M. P. Huber considers that an antennal language is in use among the ants also. He says, "The antennæ, the organs of touch, and possibly of some sense unknown to ourselves, are the principal organs of language among the ants. Their position in front of the head, their flexibility, their structure, which consists of a series of joints endowed with extreme sensibility, their intimate connexion with instinct, all combine to convince me, that the antennæ play a most important part in the history of the ants. We have seen these insects frequently use them on the field of battle, to intimate approaching danger, and to distinguish their own from the enemy's troops. In the interior of the ant-hill they serve to warn their companions of the presence of the sunbeam; in their excursions they serve to indicate the route, and in their recruiting to determine the time of their departure." Their most singular use is, however, to apprise their companions of their hunger,

and in this respect no tongue could be more eloquent. The poor hungry insect who has been stopping at home hard at work, anxiously awaits the return of the commissary ants, who have been out provision-hunting. One of the latter has just returned, and is met by one of its companions in the following pretty manner. The hungry ant begins by striking with both its antennæ very rapidly, the antennæ of the forager ant. Both insects draw closer to one another, their mouths wide open, and the forager gently transfers a portion of the food it has collected into the other's mouth. During this operation, the ant which is being so kindly fed, incessantly caresses its companion, by quickly tapping it with its fore-feet on the head, as we might pat the head of a good child, all the time moving its antennæ with every manifestation of delight.

The forager appears also able to inform her companions that she has returned home with a load of provisions, and invites them by means of her antennæ, to come and partake thereof. Says Huber, "This language is so clear to our insects that they appear instantly to comprehend

its import. Even the young larvæ, as soon as they feel the gentle tap of the antennæ, present their mouths to receive the food so kindly offered to them. The antennal language would doubtless require profound study, if we wish to be acquainted with all the impressions communicable by its means. It is, like all the other signs I have observed among these insects, based not upon any visible gestures, but upon the touch of certain parts; otherwise, it were of little service in the interior of the ant-hill, where the light of day never penetrates. In consequence of this peculiarity, a single insect cannot make itself understood by more than one of its companions at a time, but the impression is communicated from one to the other with wonderful rapidity."

M. Huber was disposed to believe that the ants could make themselves understood even by other insects. In illustration, he narrates the following fact. Watching a single brown ant on a branch of a thistle, he saw it at first pass, without stopping, some aphides, which it did not disturb, but shortly after stationed itself near one of the smallest, and appeared to caress it by touching its tail alternately with its antennæ, with an ex-

tremely rapid movement, like the play of the fingers in a shake upon the pianoforte. He saw with much surprise the fluid honey-dew escape from the body of the aphis, and the ant take it into its mouth. Its antennæ were then directed to a much larger aphis than the first, which on being caressed after the same manner, discharged the nourishing fluid in greater quantity, and this the ant immediately swallowed. In the same manner it proceeded to a third, fourth, and fifth, after which it returned to its nest. Huber concludes from this, that the aphides understand the antennal language of the ants. But this idea is probably incorrect, and has its place more in the imagination than in fact, since if we touch an aphis gently with a camel's hair pencil, it ejects the honey-dew as readily as if in reply to the solicitations of an ant. The very idea, also, of an insect of a totally distinct kind comprehending the means of intercommunication possessed by the ants, is highly improbable. The supposition is more violent than that of an Esquimaux and a New Zealander conversing together and comprehending one another.

But the general question of the existence of a

language among the ants is not affected by this error. Let us limit our signification of the word language to the following definition—the means by which the insects express their desires, their wants, or even their ideas, if we may give so exalted a title to the impulses of instinct; and it will not be difficult to furnish illustrations in proof.

If the ants had no means of communicating their mutual impressions, it would be possible to irritate those which are running about over the outside of their dwelling, without alarming those which are in the interior of the ant-hill. This is far from being the case, as any of our readers may for himself behold, if he will make the experiment. The effect of attacking these valorous insects is very curious: the greater portion of those on the outside refuse to fly, and do battle with incredible ferocity. Casting themselves upon their hind legs, they stand upright, take aim with their exploding apparatus, and discharge a shower of venom at the two-legged and gigantic foe, their jaws all the while wide expanded, and their aspect sufficiently terrible to strike some quail of terror into the heart of a strong man,—one blow of whose hand would crush

hundreds of them. But watch! while these gallant defenders of their homes are thus engaged fighting the foe, a party is seen precipitately retreating and plunging with impetuous haste into the subterranean city. Their errand is to give the alarm—the city is attacked—the walls are being scaled—the enemy is at the gates—a heroic few are fighting unto death, unassisted! The city is moved: To arms! cry the citizens; and in an incredibly short space are seen pouring tumultuously out of the gates, legions of insect warriors, so fierce, so angry, so heated, that it is evident they have been fully informed of all that has taken place outside, and on learning it have rushed to the rescue, or to a triumphant death. While this takes place outside, others within, equally informed of the danger, and of its magnitude, snatch up the infant insects, which in summer time are always placed near the surface of the ant-hill, and fly with their precious burdens to the deepest caves of the city, where they are secure from all danger. Can any actions more strongly demonstrate the fact that a means of conveying their impressions actually exists among these minute beings? What more rational

than this, could man himself do under similar circumstances, gifted though he be with mind, speech, and reason?

The manner in which intelligence is thus conveyed has been carefully studied by Huber, who gives us the following account of the proceedings of a city of Herculean ants which he attacked. When he disturbed several ants which were at some little distance from their companions, either by observing them a little too closely, or by gently breathing on them, he saw them immediately run towards the others, gently strike them on the corselet, and communicate to them by this means their anger or their alarm. They ran from one to the other in a semicircular direction, jostling sharply those which did not immediately bestir themselves. The alarmed became in turn the alarmists, running about in various circular lines, and stopping to strike with their heads all whom they met in their career. Instantly, these signs were repeated in every direction; the workers ran about in great agitation over the surface of the tree where their nest was, and hundreds from the interior, warned of the existing danger probably by a similar sign, defiled

out of the city and joined themselves to the crowd. The same signals, however, which produced upon the workers the effects described, caused a very different impression upon the male and female ants. The latter, as soon as warned of the peril, fled precipitately to the depths of the hollow cavity in the tree. But not one retired until it had received the intelligence from the worker, and the signal of flight. Sometimes these last did not seem quite to comprehend the signal, which greatly excited the alarmists and caused them to strike them repeatedly, as if to say—no time must be lost, begone at once. Generally speaking, however, they were understood instantly, and the flight of the insects was immediate.

A most ludicrous scene narrated by the same author, seems to point equally distinctly to the possession of a certain language by these insects. The artificial formicary with which he experimented being placed on a stand with four legs, was isolated from the floor by the legs being placed in vessels full of water. The ants delighted to come down and quaff the refreshing fluid in the hot summer days. One day, when several were busy drinking the water which

had soaked through the fibres of the wood, and which they preferred to the fluid in the vessels, Huber did something to disturb the little water-drinkers. The greater part ran immediately up the leg of the stand to the ant-hill above; a few however remained undisturbed and quaffing away with all their might. But one of the more cautious, perceiving the peril of its companions, undertook the hazardous task of descending the leg to apprise them of their danger. Approaching one frolicsome insect who was thoughtlessly amusing itself in this position of peril, the alarmist struck it sharply, and so thoroughly frightened the gamboller that he took to his legs and ran up to the nest with great alacrity. A second, and a third were then warned, and each retired in all haste to the nest. But a fourth, the only one now left, stood drinking at the very edge of the water altogether heedless of the proceedings of its companions. In vain did the bold alarmist strike it again and again; the drinker would not quit its place, nor forego the pleasures of the draught, though at the peril of its life. The alarmist much concerned at this insect's shocking fool-hardiness, took hold of one of its hind legs

and gave it a sharp pull. The other, opening its jaws, turned fiercely round as if to say, let me alone, and then began to drink again. But scarcely had it time to taste the seducing fluid when the alarmist, out of all patience, seized the water-intoxicant between its mandibles and carried it struggling and kicking up to the safe asylum of the nest.

When an ant has lost its way, or when the whole community is about to seek some new place of abode, there are many singular illustrations of the existence of a kind of language among these beings. One which has found a suitable abode will come back to its companions, make certain gestures with its antennæ and direct them in the route they should adopt to reach the spot. Every time they meet each other in these journeys they stop, and appear to hold a conversation by means of their antennæ, after which they seem to be better acquainted with the proper road.

Dr. Franklin related to the Swedish traveller Kalm the following observation of his own with reference to the language of insects. Having placed a pot containing treacle in a closet infested with ants, these insects found their way into it,

and were feasting very heartily when he discovered them. He then shook them out, and suspended the pot by a string from the ceiling. By chance one ant remained, which, after eating its fill, with some difficulty found its way up the string, and thence reaching the ceiling escaped by the wall to its nest. In less than half an hour a great company of ants sallied out of their hole, climbed the ceiling, crept along the string into the pot and began to eat again. This they continued until the treacle was all consumed: one swarm running up the string while another passed down. It seems highly probable that the one ant left behind at first had conveyed the tidings of the treasure to its companions, and directed their steps to the only way of access to it, namely, across the ceiling and down the string.

Among the bees there are certain signs which seem to be almost as well understood, as the more tangible means of communication among them and the ants. On breathing through a cleft of their habitation, offence is immediately taken by the inhabitants, and sharp, interrupted, buzzing sounds are produced. The workers on perceiving these sounds immediately

put themselves in agitation, and direct themselves away from the side at which the air has entered. Among the white ants the signal of alarm is a loud hiss, often so loud as to imitate that of a serpent, and to startle the incautious traveller who has disturbed one of their armies. Mention has already been made of the signals employed by the soldiers among these insects. The loud tap of the former, which seems like a command to expedite the work, being responded to by the obedient hiss of the latter, and by redoubled activity in their proceedings. House crickets have a somewhat similar signal. If surprised by a candle when running about in a room at night, they give two or three shrill notes, which seem to warn their companions that they may escape to their crannies and lurking holes, and so avoid the danger.

The following anecdote, related by Messrs. Kirby and Spence, strikingly manifests the existence of a sort of communication of ideas even among a species of beetle. A German artist, a man of strict veracity, states, that, in his journey through Italy, he was an eye-witness to the following occurrence. He observed a species of

Scarabæus busily engaged in making, for the reception of its egg, a pellet of dung, which when finished it rolled to the summit of a small hillock, and repeatedly suffered to fall down its side, apparently for the purpose of consolidating it by the earth, which each time adhered to it. During this process the pellet unluckily fell into an adjoining hole, out of which all the efforts of the beetle to extricate it were in vain. After several ineffectual trials, the insect repaired to an adjoining heap of dung, and soon returned with three of his companions. All four now applied their united strength to the pellet, and at length succeeded in pushing it out: which being done, the three assistant beetles left the spot and returned to their own quarters.

Here we may conclude our illustrations of this interesting subject. In every natural science, truth unmixed with fable, and unexaggerated by the imagination, ought to be a chief object of our search. We feel this especially necessary to be borne in mind when considering such a subject as that of the present chapter. If the distinguished naturalist, Fabricius, could feel that nothing in natural history was more diffi-

cult and abstruse than an accurate description of the senses of animals, how much more abstruse is the investigation of their language or means of intercommunication,—if they possess any. We are told by Göedart, that in every humble-bee's nest there is a trumpeter, who early in the morning mounts to its summit, vibrates his wings and sounds his trumpet for a quarter of an hour, so rousing up the inhabitants to their daily task. Here, is a mere fable, unworthy a real student of nature. Again we are informed by Butler, that the young queen and the old queen of a hive, hold a touching conversation, mingled with earnest entreaties, lamentations, and groans on the part of the former. This is an example of truth exaggerated by a too vivid imagination. Let us in our thoughts on the language of insects avoid both errors, and be content with the delightful, solid truths, offered to us by Modern Entomology.

From all that has been said, it appears certain that among several insects, a sort of language really exists,—that is, they can tell tidings to one another, which according to their nature produce different effects upon the auditors. The organs by which these communications are made,

are among bees and ants more generally the antennæ than other parts of the body. But both among these and other insects, other signals, which are equivalent to an obscure and imperfect sort of language, also exist, producing impressions upon their senses which influence and determine their conduct. On the whole, the language of insects is limited to a very few ideas,—enough, however, to secure their well-being—enough to manifest the wisdom, love, and power of God who made them.

M. Huber sensibly observes, “There is nothing repugnant to our conceiving the subsistence of a language among beings whose instinct is so enlarged as that of bees; whose conduct is compounded of a thousand proceedings, and which combined in great numbers, cannot share their respective labours, or aid each other suitably, without the means of mutual communication. The like observation applies to all insects dwelling in society, as well as those larger animals regulated by the same conditions.”



CHAPTER VIII.—AN INSECT CONCERT.
THE CUCADA, FIELD-CRICKET, AND GRASSHOPPER ARE THE INSECT MUSICIANS.

CHAPTER VIII.

MUSIC OF INSECTS.

“Drunk with the dewdrop, perched on twig so lofty,
 Noisy Cicada, o’er the wild waste sounding,
 Saw-like the feet, which to thy side thou pressest,
 Drawing sweet music.”

MUSIC may, perhaps, be too fine a term to apply to the sounds made by insects. Their powers of song, if we may so speak, are feeble, and their notes monotonous, and perhaps, to many ears, little melodious. At the best, insect music is not comparable to that of the feeblest songsters among the birds. Yet it is pleasant of its kind; and when

“Far from all resort of mirth,
 Save the Cricket on the hearth,”

we must acknowledge that the sharp, unitoned minstrelsy of this little being is far from unpleasing to the ear or to the heart.

In birds, and in man, music is connected with the organs of the voice, and is produced by the rapid vibration of certain structures in the air expelled from the lungs. But the case is different in insects. Not being furnished with organs like our lungs, or an air passage like our windpipe, their music cannot be produced by the same or similar mechanism to our own. They have no voice, properly speaking; they have not, therefore, in strict propriety, the power of song. Instead of a voice, those insects which are capable of producing sound, are supplied with musical instruments! In place, therefore, of calling these insects songsters, they are more correctly designated musicians, and their song is, in reality, a musical performance. It is proposed by M. Goureau, in an elaborate article in the *Annales de la Société Entomologique de France*, to call the sounds produced by insects by the term, 'stridulation.' Let us, however, confine ourselves to the simpler and more intelligible expression, insect music, explaining, as we proceed, the various instruments with which insects are furnished, and among which we shall find types of the violin, the drum, the timbrel, &c.

Let us begin with our domestic and field musicians, the crickets. This little creature commences his minstrelsy when the shades of evening close in, when the fire burns brighter, and all is made snug for the night. If we would best enjoy this musician's performance, let us put out the lights, leaving only the glowing embers to

“Teach light to counterfeit a gloom,”

then out comes the musician, out comes his partner, and a troop of insects run along the floors, while the performers strike up in their lustiest tones. The learned Scaliger, we are told, so delighted in the cricket's music that he was accustomed to keep them in a box in his study, where their performance cheered and enlivened the tedious hours of his application. Messrs. Kirby and Spence tell us, quoting from an old author, that these little musicians are kept in a sort of iron oven and sold in Africa at a high price, to procure sleep. Our little minstrels thus taking the place of those human performers, whose duty it used to be to lull royal and noble personages to composure,

or to sleep. Sometimes, however, our musicians are more noisy than agreeable, and a war of extermination is threatened against them by the occupants of our kitchens. This, however, in consequence of a popular superstition, that some evil will befall the destroyer of our minstrels, does not often happen. Occasionally, sad to relate, these mirthful creatures are wilfully poisoned, with a red compound well-known to most of our cooks.

It is only in the adult state that crickets are musical; they are mute in the larva and pupa states. It is only the male insect which can produce music, the female being silent; and it is generally for the amusement and attraction of his partner that our musician strikes up and commences his performance. The field-cricket generally places himself at the entrance of his habitation, and there begins to sing. His partner, attracted by his performance, approaches, and on meeting, he generally lowers his tone to a sweeter and softer sound, interrupted by a short, sharp, sound; no doubt intended as a greeting. The insects then take several little turns about the habitation, from which they do

not go far. Ludicrous is it to behold this pair, the musician elate and proud of gait, preceding his mate, and walking with short steps a little before her! When this insect sings, it begins by stretching out its legs, placing his breast upon the ground, at the same time slightly elevating the abdomen; in this attitude he raises the wing-covers, and rubs them briskly against each other. The sound produced is louder and stronger in proportion to the rapidity of the motion, and the degree of pressure.

The musical instruments of the crickets closely resemble each other in all the species of these insects. It consists simply in the peculiarly formed wing-covers or elytra. On examining one of these it is found to consist of a thin, dry, transparent membrane, divided into numerous compartments by the nervures which intersect it. M. Goureau gives a minute description of this apparatus, too technical and complicated for these pages. The arrangement, however, of the nervures of these wing-covers is such, that when the one is crossed over the other they rub against each other, and so produce a vibration sufficiently rapid to create a musical sound. The

musical instrument of the cricket is compared by M. Goureau to a tabor divided into a great number of compartments by cords fastened to the skin, which is crossed by a large knotted cord, the manner of playing on which is supposed to be, by passing over this cord a plate of some sonorous metal.

By raising the wing-covers, and rubbing them against each other by means of a pin, the sound may be artificially produced on a living insect, or even on a dead one provided its joints retain their pliability. The sounds thus produced, are not so loud as those which are made by the insect when alive and at liberty, but are sufficiently so to enable any one to recognise them. As a satisfactory proof that such is really the mechanism by which our shrilling friends produce their evening concert, if one of the wing-covers be cut off, the insect becomes silent. It may be seen trying to sound its tabor, but no longer able to draw forth its music.

Whilst it may appear to some, that there is little pleasing to the ear in the shrill minstrelsy of the crickets, either by the fireside, or in the field. Yet to many, few sounds are more de-

lightful in a balmy summer's day than the vigorous music of the cricket of the field, when the herbage and the hill-side are vocal with their songs. Then our minstrels form a not unimportant part of the scenes which delight the eye and please the ear, and we can adopt the language of the poet as our own, feeling the truth that

“Sounds inharmonious in themselves, and harsh,
Yet heard in scenes where peace for ever reigns,
And only there, please highly for their sake.”

The grasshopper is the next minstrel to whom we shall call attention. The male insects alone are capable of producing music, which they do for the satisfaction of their mates. Three or four sometimes collect together, and a grasshopper concert is then performed upon the leaves of a shrub. Impassioned musicians are the grasshoppers! Intense is the delight they appear to take in their performance, and wonderful the emulation with which each endeavours to outdo the others. In these concerts, it has been observed, that the musical instruments are not always quite in tune. The grasshoppers do not seem to be endowed with as much taste

and ear for music as they are with love for the art. In their mutual performances some will be heard in a very high, clear, treble tone, performing with all their might, whilst others, with equal vigour, draw forth only dull, harsh, bass notes, out of their instruments, little in accord with the first. It is generally supposed that the latter are old minstrels, who have worn out their instruments by frequent use, the former being young performers upon new instruments.

Upon close scrutiny of our performer, and on detaching his wing-covers, we shall see the instrument on which he plays. "On looking at the right wing-cover from above," observes M. Goureau, "we see an oblong, transparent space, which is of a hard consistence, and sonorous, to which the name of drum may be given. It is surrounded by a border, which is thickest at the interior margin, to which I have given the name of treble string. On the top of the left wing-cover, viewed from below, a dilatation is seen analogous to that of the right, but not so transparent. What is most remarkable about it, is a thick nervure, striated like a file, which crosses it in a nearly parallel direction

to its upper border, which I have named the bow." By the mutual action of these parts against one another, the music is produced. When the sounds are dull and harsh, it is supposed the teeth of the bow have become worn by frequent use.

The saddled grasshopper (*Ephippiger*) is a very noisy musician. Both male and female insects are performers, and their music (!) has been compared to *that* produced by passing the nail up and down a fine-toothed comb, stopping a short time between each turn. The male insect, however, is the louder minstrel of the two.

To an insect-violinist, in the shape of the locust, we have now to introduce the reader. All species of these insects are not equally good performers, nor are possessed of equally perfect instruments. Their song is sharp and monotonous, composed of innumerable couplets of eight or ten seconds in length, separated by an interval of two or three seconds. Seated upon a leaf or shrub, our musician strikes up, and, for some time, performs with great assiduity. If he then finds, that, in spite of his tunefulness, no female insect has come out to hear him, he

flies off, and settling on another plant, begins again. If, however, he sees his companion approach, his performance becomes still more vigorous; but, upon her drawing nearer still, its tone is altered to a softer and tenderer note. The musician, while performing, stands on his four front legs, and doubles the hind legs up against the thighs, he then rubs his thighs rapidly against the wing-covers. If a first-rate performer, he will be seen rapidly moving his limbs in this manner, and for a long time. Sometimes the insects may be seen performing without producing any sensible tones; but, in all probability, our ears are unable to distinguish these finer notes, which may fall with softened sweetness, it may be, upon the senses of the insects themselves.

The instrument itself is analogous to a violin. In the wing-covers are several arrangements of nervures over two transparent spaces, which produce a structure comparable to that of a violin. These nervures resemble the strings, and a pin cannot be passed over them without causing them to vibrate. The thigh of the hind leg of the insect is so formed as to represent in some

degree the bow with which the violin is played. When the locust performs, he passes his thighs against the wing-covers, pressing them at the same time, and in so doing the thigh acts upon the wing-cover, as the bow upon the strings of a violin, and music is produced. The sounds are livelier and louder in proportion as the movements are more rapid, and the pressure more considerable.

Our next musician—the Cicada, has been immortalised in the songs of the Grecian poets. Supposed, say Messrs. Kirby and Spence, to be perfectly harmless, and to live only upon the dew, they were addressed by the most endearing epithets, and were regarded as all but divine. The verses of Anacreon are so beautiful, and have been so well rendered by that pleasant writer, Rusticus of Godalming, that we shall transcribe them.

“ Happy Cicada, perched on lofty branches,
 Deep in the forest, cheerful as a monarch,
 Tasting the dewdrops, making all the mountains
 Echo thy chirping.

“ Thine is each treasure that the earth produces ;
 Thine is the freshness of each field and forest ;
 Thine are the fruits, and thine are all the flowers
 Balmy Spring scatters.

“ Husbandmen proudly doat upon thy friendship,
Knowing thee guiltless of a thought to harm them ;
Thee mortals honour, sweet and tuneful songster,
Prophet of summer.

“ Thee, all the Muses hail a kindred being ;
Thee, great Apollo owns a dear companion,
Oh ! it was he who gave that note of gladness,
Wearisome never.

“ Song-skilful, earth-born, mirth- and music-loving,
Fairy-like being, free from age and suffering,
Passionless, and pure from this earth’s defilement,
Almost a spirit.”

These are very pretty lines ; but Virgil calls the cicadas querulous, and declares that they burst the very shrubs with their din,—which is not quite so complimentary. Whether the Grecian species of these insects were really capable of producing pleasant sounds or no, it is not easy to say. It appears most probable that the insect was looked upon rather as an emblem of the science of music, than as being itself so very melodious in its note. Or perhaps, sounds which to us are unpleasing, might have had a charm for Grecian ears, to which ours are strangers. In other countries the cicadas are

less favourably received in their minstrel capacity, and if we contrast the matter-of-fact account given in Dr. Shaw's "Travels in Pennsylvania," with the poetical description of our musician given above, the result is quite ludicrous. "In the hotter months of summer," says this writer, "especially from midday to the middle of the afternoon, the cicada is perpetually stunning our ears with its most excessively shrill and ungrateful noise! It is, in this respect, the most troublesome and impertinent of insects, perching upon a twig, and squalling sometimes two or three hours without ceasing, thereby too often disturbing the studies, or short repose, that is frequently indulged in these hot climates, at these hours." Messrs. Kirby and Spence state that they were informed by Captain Hancock, that the Brazilian cicadas sing so loud, as to be heard at the distance of a mile. This is almost as if a man of ordinary stature, supposing his powers of voice increased in the ratio of his size, could be heard half over the world! We are fortunate, if such be the case, that these tremendous performers have never yet made their appearance in Britain. It is stated, how-

ever, that a species of cicada has been found in the New Forest in Hampshire.

Mr. Bennett, in his "Wanderings in Australia," gives us the following account of the cicada in that country:—"As the summer season was now fully set in, the previous silence of the woods was broken by the incessant shrill, chirping noises which resounded over them, occasioned by the male cicada. The musical organs, or drums, are only found in the males. The aborigines call these insects galang, galang, and formerly used them as food, first stripping off their wings. They ate them in the raw state; that is, as the native blacks told me. 'When no white feller here, no black feller get bread or yam;' (meaning, probably, that before the colonization of the country, its native inhabitants were without bread or yams, and were compelled to subsist upon our minstrels.) My notice was particularly directed by the natives to the drums in the male insects, as the means by which they produced their thrilling sounds, at the same time adding, in their peculiar English, 'Old woman galang, galang no got, no make a noise;' implying that the females do

not possess these musical instruments. There are several species of this genus known in Australia. During rain these insects are silent, but recommence their clamour on the appearance of fine weather." The fact of the female cicada being mute was also known to the Greeks, who have on record the following couplet on the subject :—

“ Happy the Cicadas’ lives,
Since they all have voiceless wives.”

Happy we too, for surely if both male and female insects were as clamorous as they have been described, some parts of our world would be uninhabitable for their din.

Dr. Hancock in a communication to the Entomological Society, states that “ The insect whose song is most frequently heard in Guiana, is the *Cicada clarisona*, the Aria, Aria, of the Indians, and ‘ Razor-grinder,’ of the colonists. In the cool shades of the forests it may be heard at almost every hour of the day ; but in George-town its song commences as the sun disappears below the horizon.” At George-town this insect was never heard in 1804, when Dr. Hancock

first visited the place, but now it is very common, probably in consequence of the shelter afforded by the growth of many trees and shrubs in the gardens which have since been formed there. The sound emitted by it, is a long continuous shrill tone, which might be compared almost to that of a clarionet, and is little interrupted except occasionally by some vibrating undulations.

Now for a description of its instrument. Réaumur has given a most elaborate account of the insect and its musical organ, which is quoted in the classical work of Messrs. Kirby and Spence, from whose pages we shall extract a part of it. "If you look at the underside of the body of a male, the first thing that will strike you, is a pair of large plates of an irregular form, in some semi-oval, in others triangular, in others again a segment of a circle of greater or less diameter, covering the anterior part of the belly, and fixed to the trunk between the abdomen and the hind legs. These are the drum-covers or opercula, from beneath which the sound issues. When an operculum is removed, beneath it you will find on the exterior side, a

hollow cavity, with a mouth somewhat linear, which seems to open into the interior of the abdomen. Next to this, in the inner side, is another large cavity of an irregular shape, the bottom of which is divided into three portions. Of these, the posterior is lined obliquely with a beautiful membrane, which is very tense, and reflects all the colours of the rainbow." This is called the "mirror," and is supposed to modulate the sound.

"But even all this apparatus is insufficient to produce the sound of these animals:—one still more important and curious yet remains to be described. This organ can only be discovered by dissection, a portion of the first and second segments being removed from that side of the back of the abdomen which answers to the drums; two bundles of muscles meeting each other in an acute angle, attached to a place opposite the first ventral segment of the abdomen, will appear. These bundles consist of a prodigious number of muscular fibres applied to each other, but easily separable. Whilst Réaumur was examining one of these, pulling it from its place with a pin, he let it go again,

and immediately, though the animal had been long dead, the usual sound was emitted. On each side of the drum-cavities, when the opercula are removed, another cavity opening into the abdomen, is observable." This apparatus constitutes the true musical instrument of the cicada, all the other parts are subsidiary to it, and in various ways arrest and modify the sound. "In the cavity last described, you will discover a semi-opaque, and nearly semicircular concavo-convex membrane, with transverse folds; this is the drum." Each bundle of muscles before mentioned is attached by little tendons to the under surface of this membrane, and by its play will consequently draw in or let out the drum. In so doing, a sound is produced, which, passing under the drum-covers before it can be heard in the air, is modified by them. If in a child's drum we fasten, by means of sealing wax, a string to the outer surface, and another to the inner surface of the parchment at one of the ends, and sharply pull either of these ends, we shall get a good idea of the drum of the cicada. Well may we say, "what adorable wisdom, what consummate art and skill are displayed in the

admirable contrivance and complex structure of this wonderful, this unparalleled apparatus."

M. Goureau seems disposed to believe that the emission of air from the body of the insect performs an important part in its song. Upon its manner of performance he has the following observations. "When the insect sings in a box, no motion is observable in the wings, nor in any other part of the body: when I held it between the fingers in such a way as left the abdomen free, its voice was as strong as usual. But if I held its body, and pressed the drum-covers against the abdomen, it was dull, faint, and stifled. If, on the contrary, I raised the abdomen, so as to leave the cavities, which are generally covered by the drum-covers, open, the voice became unusually loud and strong. This led me to conclude that the drum-covers perform the office of keys, and serve to modify sounds; but these keys, instead of being moveable as in wind instruments, are fixed: the abdomen is moveable. This will explain why the Cicada, when at liberty, is constantly moving its abdomen during the time it is singing, alternately elevating and depressing it. By this

means it obtains a variety of sounds from the musical instrument, and produces modulations which, though we are not sensible of them, are assuredly perceptible to the insect himself, or to the female whom it is his object to please."

When savage nations go out to war with one another, so soon as each party perceives the advancing hosts of their enemies, they endeavour to intimidate each other by the most terrible war-cries. The din of their musical instruments, rising with the yells of the warriors, and the clattering of the weapons of war, is expected to strike terror and dismay into the heart of the foes. Perhaps when one side boasts of two or three warriors whose howlings are unusually awful, such a result may occasionally be really produced. But we have to speak of an insect gifted with a musical instrument, by which it can successfully intimidate its insect enemies, and more than once has terrified men and women. This insect is the death's head hawk-moth, *Acherontia atropos*.

The sound emitted by this insect is peculiarly plaintive. We are told that a certain divine, who was also an entomologist, having

had one of these insects brought to him when he was unwell, was so moved by its plaintive minstrelsy, that instead of devoting it to destruction, and to impalement for his cabinet, he gave the creature its life and liberty. When taken captive, or threatened with danger, the insect invariably begins performing upon its lugubrious instrument, and continues to do so until silenced by death, or set at liberty again.

The instrument of this insect has been long disputed about. The accurate Réaumur fell into a great error, and supposed its music was produced by the friction of its proboscis against the palpi. Others have not been more fortunate in their attempts to solve the problem. The author we have frequently quoted in the present chapter, appears to have discovered the true source of its melancholy music. From his researches, it appears that in the abdomen of the insect there is seated an apparatus not unlike that of the cicadæ. He discovered a muscle connected with a hollow drum-like cavity, the action of which rendered it, as in the former insects, concave or convex alternately. In so doing the sound was produced.

In all the instances of insect minstrelsy hitherto alluded to, the principles on which their instruments are constructed are very simple, and are referable to two heads. 1. The instrument is a thin, transparent membrane, caused to vibrate by an apparatus resembling the bow of a violin: or 2. It consists of a thin sonorous membrane acted on by a muscle, which throws it into alternately convex and concave forms, causing it to vibrate in so doing. From this it is evident that the Grecian poet, who wrote the pretty lines at the head of this chapter, was ignorant of the mechanism by which the cicada produced its music. The insect is there represented as “pressing its saw-like feet to its sides, and so *drawing sweet music*”—that is as a violinist, whereas it will be plain, from all that has been written, that the cicada is, more properly speaking, a drummer, only that it has its drum muffled and so complicated, as to constitute a very remarkable instrument.

Madame Mérian, who, however, was a little *too* credulous, and has related much that is incorrect and absurd, states that in the forest of Surinam, she was informed by the natives

that an insect abounded, which produced music like that of a lyre. It was called by them the lyre-player.

The subject of the music of insects need not be pursued farther. Enough has been said to justify the claims of insects to the powers of minstrelsy, although their music is not of the most refined character. Humble though their note, and oftentimes harsh their tone, we cannot doubt that they therein show forth the praise of their great Creator not to a less degree than the most gifted warblers among the feathered tribes.



CHAPTER IX.

INSTINCT OF INSECTS.

THERE is not a more difficult and perplexing subject in all natural history, than that of Instinct. Men of science have perplexed themselves and their readers in no ordinary degree in their attempts to make the matter clear, and we remain still unenlightened upon the great question at issue,—the nature of instinct, and its relation to reason. It appears that much dispute might have been saved, had naturalists been content with the possession of facts, manifestly out-lying their power of explanation; and without creating confusion by attempting to account for them, had they simply been satisfied with the knowledge of the habits and actions of insects thus revealed to them. We are at a loss oftentimes to account for the actions of our fellow-creatures, or to define the impulses which could have actuated them. How much more ignorant must

we be of the causes and impulses which determine the manœuvres of an insect, between whose sensations and our own there can exist little if any analogy. We shall learn from the facts to be detailed, that God in his abundant goodness and wisdom has given to insects a light to guide their plans for their mutual welfare, and to assist them in combating unexpected difficulties in so doing. This light is sufficient of its kind, and being so, why need we vainly perplex ourselves by unsatisfactory and profitless disputations? Let us rest content with the following view of the case. It is needful for many insects to have the faculty of adapting themselves to circumstances which may befall them in the performance of their ordinary occupations. It is needful also that they should possess a certain degree of knowledge, of skill, and of memory; these faculties may be comprised under the general term instinct. We may now, therefore, proceed to the more pleasant and interesting duty of exhibiting some illustrations of the intelligence of these minute creatures.

Lieut.-Col. Sykes describes the actions of some ants which annoyed him in India, which

appear strikingly to set before us the instinct of these little beings. He says, "The magnitude of these ants, their voracity, and remarkable tact in discovering saccharine matters, render them repulsive, troublesome, and costly insects in a house. I have had the greater part of a tub of sugar-candy, left in my store-room at Poona, and weighing nearly half-a-hundred weight, consumed by them during a few months' absence from home. And my friends here related to me instances of similar depredations, carried to the extent of the consumption of a whole tub of sugar-candy. However incredible the fact may appear, I will not omit to notice an instance of their instinct literally bordering upon human intelligence. It was the practice in my family to leave the dessert, consisting of fruit, cakes, and particularly China preserved fruits, constantly standing upon a sideboard in an enclosed verandah off the dining-hall. A cloth was thrown over it, and to prevent the access of insects, the legs of the table were placed upon low pedestals in little stone pans filled with water. When I first took possession of the house, the inhabited part was not infested with this species of ant,

but the attraction of the sideboard soon occasioned their introduction. The channel of water surrounding the pedestals did not prove a sufficient barrier. The pans were shallow, and the channel not wider than two lengths of medium sized ants. When the water was low they waded across, and when the pans were full, they boldly pushed over, and succeeded in catching hold of the opposite bank with their fore-legs ere they sunk, and once over they soon reached their rich repast by the legs of the table, and in the morning I found hundreds congregated in the China sweets. They were put to death; but each succeeding day presented similar hordes of equally bold and successful adventurers.

“I now had the legs of the table surrounded daily with a belt of turpentine, just above the level of the water, and this proved effectual, either from its nauseous and deleterious scent, or from its clamminess, holding them by the feet. For some days the sweets were unmolested, but eventually the ants found their way back to them, although not in such numbers as before, and I did not readily discover by what means. The edge of the table was about an inch distant

from the wall, and with greater facilities of access, they did not risk the danger of passing the gulf between the table and the wall. But reduced to extremities by my precautions, the largest ants now essayed to pass it, holding on the wall by the hind legs, while the front legs were stretched out to touch the edge of the table, and the contact enabled very many to cross. The table was now removed from the wall beyond the maximum stretch of the largest ants, and I flattered myself that I had triumphed over their perseverance and ingenuity. But to my infinite surprise, in a few days the sweets teemed as usual with the intruders, and I was puzzled in no small degree to account for their reappearance. Accidentally passing the table, I observed an ant upon the wall, about a foot above the level of the sweets:* it fell, and instead of passing between the wall and the table, and alighting upon the ground, the insect fell upon the table. Can it be possible, I said to myself, that this fall is designed? I stood to observe with the most intense curiosity. Another ant ascended, and dropped with similar success: another and

* See Frontispiece to this Chapter.

another followed; and there was no longer doubt that instinct (if instinct I must call it) had made them a match for reason. But what is this 'instinct,' or 'impulse of nature,' which enables an animal to do that which, in those things that man can do, result from a chain of reasoning, and in things which men cannot do, is not to be explained by any efforts of the intellectual faculties,—by which the captive and expatriated pigeon on its release, flies directly and unhesitatingly through the pathless air, to its distant home; by which the far-removed dog returns to his master by previously untravelled and unknown routes; by which the bed-bug, it is said, if cut off from access to the bed, by the feet or draperies, ascends to the ceiling, and falls upon the canopy, and by which this ant was enabled to defeat all my precautions." *

The insects which live in communities, like the ants and bees, must be expected to furnish us with the most striking displays of insect intelligence. They appear, in fact, to have been peculiarly gifted by the Divine Author of Nature with faculties of a superior order to those

* Transactions Entomolog. Soc. vol. i. p. 106.

possessed by insects that dwell alone, and they are, consequently, able to seek for food under peculiar emergencies, when other insects would be at a loss what to do, and would remain inactive or in despair. The Rev. W. Cotton relates the following anecdotes of the conduct of some bees which came under his notice. He says, "I have a hive called the Observatory hive because in it I can observe or watch all the bees do,—as Huber would say, mark all their manœuvres. It is made of two plates of glass, placed in a frame, just one inch and five-eighths in the clear; this gives them room to build one comb, and no more, so I can see every bee at work, and not even the queen herself can long hide from me. I put a swarm in, and they built a comb, which, by a sudden jerk, was broken off from the top. I knew the bees were not strong enough to lift it up into its place, so I was curious to see what they would do, and I watched them narrowly. They first held the broken comb in its place, just as Huber saw their first cousins, the humble-bees, do; they next made wax, and fixed the broken comb firmly in its place. They then went on to saw

off with their sharp and strong jaws, just enough of the comb which pressed against the glass, to let themselves pass. One poor bee had got pressed between the plate of glass and the comb. They very kindly began to saw away the comb in that place which set the poor bee soonest at liberty. They might have begun anywhere else, but instinctive kindness led them to begin where they did. This they did more evenly than I could have done for them, the size of their bodies being the rule by which they worked. A razor could not have cut sharper. Last of all, they lengthened the cells on the other side, so that the whole comb was the same thickness as before, though made of long cells on one side, and short on the other.

“Another time I saw a bee in the same fix, for he had slipped down with his feet to the glass, and his back toward the comb, so that he could not get a firm hold, to exert that power which was needful to set him free. Another bee saw his hard case, and went straightway to succour him, laid hold of his hind legs with his jaws, tenderly no doubt; but I am sorry to say, he did not stand by him till he got free.”

The same writer put the ingenuity of the bees to the test in another way. He had a strong stock of bees in a straw hive, on the top of which he put a large glass, which they soon filled with comb, as the light was quite kept out, this glass had a flat wooden top with holes, upon which bell-glasses were placed. Taking a single flower of stock, and lifting off one of these glasses, Mr. Cotton dropped the flower in amongst the bees. This created a great tumult among the inhabitants of the hive, who determined to eject the intruding flower. They seized it with their powerful mandibles, carried it up into the bell glass which had been restored to its place, and worked it round and round, trying in vain to discover the aperture by which so unwelcome an object had been dropped into their midst. The bell-glass entirely covering the top of the hive, they were of course unable to find out the place, and the flower in their bustle dropped down again. Again with incredible efforts they carried it, though twenty times the weight of a bee, to the bell-glass. And again it fell. They did this many times with great perseverance, until Mr. Cotton com-

passionating their efforts, lifted the glass, when they flew away with it, and returned to the hive by the proper entrance. In this case, the bees seem to have been aware that by carrying the flower to the entrance of the hive, they would have created great confusion and turmoil among its inhabitants, and they therefore made the attempt to carry it away by the same way that it came. During this Herculean undertaking, one bee, which had a strong grip of the flower, dragged it up the side of the glass whilst six others were hanging on to it, which is as if one man were to drag up a perpendicular glassy precipice, an omnibus with its two horses, and six passengers inside.

Dr. Bevan relates a very striking illustration of the power of instinct in bees, which occurred under the observation of Mr. Walond. Inspecting his bee-boxes at the end of October 1817, he perceived that a centre comb, burthened with honey, had separated from its attachments, and was leaning against another comb, so as to prevent the passage of the bees between them. This accident excited great activity in the colony, but its nature could not be ascertained at the time. At the end of a week, the weather being

cold, and the bees clustered together, Mr. Waulond observed through the window of the box, that the bees had constructed two horizontal pillars between the combs alluded to, and had removed so much of the honey and wax from the top of each, as to allow the passage of a bee. In about ten days more, there was an uninterrupted thoroughfare, the detached comb at its upper part had been secured by a strong barrier, and fastened to the window with the spare wax. This being accomplished, the bees removed the horizontal pillars first constructed, as being of no further use. What an amount of engineering skill and perseverance was exhibited in this undertaking!

The conduct of bees in glazed hives is often highly remarkable, and exhibits their power of adapting their operations to the circumstances in which they may be placed very strikingly, since the material of which, in great part, their house is constructed, namely glass, being an artificial production, would never be presented to them in a state of nature. Dr. Evans tells a singular story of some bees thus placed. "Having frequently observed," he writes, "on the inside

of my glass hives, prior to the formation of cells, a number of gluey spots ranged at regular distances, I supposed them at first to be intended as a kind of land-mark pointing out the divisions of the future streets. On re-examination, however, I found them evidently used as so many foot-stools on the slippery glass, each bee resting on one of these with its middle pair of legs, while the fore-claws were hooked with the hind ones of the next above, thus forming a living ladder by which the workers were enabled to reach the top, and pursue their favourite plan of commencing their combs there."

Huber put the ingenuity of bees to remarkable trials, in his experiments on the modifications of their architecture in glazed hives. He tried to confound the industrious architects by placing them in a hive, the top and bottom of which were made of glass, upon which the bees are unable to lay the foundation of their cells in consequence of its slipperiness. The sides of their dwelling were, however, of wood. But the bees were not at a loss how to proceed even under these trying circumstances. They sent a body of architects up to the upper angle where

the glass and wood met, and there the insects began to build, constructing their combs perpendicular to one of the sides, and as regularly as those which they usually build under a horizontal surface.

Huber put the bees to a still greater trial. As they now testified their inclination to carry their combs in the shortest way to the opposite side of the hive—for they preferred uniting them to wood or a surface rougher than glass—he covered it with a pane. Whenever this smooth and slippery material was interposed between them and the wood, they departed from the straight line hitherto followed, and bent the structure of their comb at a right angle to what was already made, so that the prolongation of the extremity might reach another side of the hive which had been left free. Varying this experiment in several ways, the bees still constantly changed their combs whenever the smooth surface of the glass was presented too closely, and they always sought the wooden sides. Huber thus compelled the poor insects to curve their combs in the strangest shapes, by placing a pane of glass at a certain distance from their edges.

These results indicate a degree of instinct truly wonderful. The bees seem aware of the unsuitableness of glass for their dwellings to form the foundation of their cells upon ; yet in a wild state no such material hinders their proceedings, and we can only wonder without being able to explain, how they are able to act in emergencies like these to which in a state of nature they would never have been exposed. Nor can we the less wonder at their together altering their structures as if animated by one common mind, or directed by a single individual. How can every one of the insect architects, each bearing its own part, become acquainted with the plans of its companions who are hard at work at some distance from itself? In this the insects display an intelligence superior to man, for our labourers require a ruler and guide, and all their proceedings are planned and fixed by a single person who directs and overlooks the whole.

Two remarkable anecdotes of the instinct of bees have been narrated by different authors, which deserve remembering. The first occurred to M. Réaumur. A snail having crept into one of his hives early in the morning, crawled about

for some time, and then fastened itself and its house by its slimy adhesiveness to one of the glass panes, where, but for the bees, it would probably have remained till either a moist air, or its own spume had loosened the adhesion. The bees having discovered the snail immediately surrounded it, and formed a border of the sticky glutinous material called propolis, to which allusion has been before made, round the verge of its shell. This they continued to raise until the edge of the shell was at last so securely fixed to the glass as to become immoveable either by the moisture of the air from without, or by the snail's secretion from within. The unhappy snail was thus kept a close prisoner within his own domicile, and without the smallest hope of being ever able to get out again. The bees had in fact treated him like some of the unfortunate criminals, of whom history has narrated that cruel men have caused them to be immured alive.

The second is still more singular. It is related by Maraldi, and is quoted by Dr. Bevan, in his book on the bees. A houseless snail or slug had entered one of Maraldi's hives. The bees, astonished at the boldness of the

intruder, crowded around it, and instantly a hundred envenomed weapons were thrust into its defenceless body. The wretched slug, pierced with wounds, quickly expired; and now the bees were in as great an emergency as ever. Their united efforts were unequal to the dislodgment of the carcass of the slug, and if permitted to remain, it would, by its putrefaction, empoison the whole atmosphere of the hive, and endanger the lives of the citizens. As if aware that such would really be the case, they quickly covered it over with an impervious coating of propolis, until the animal was so thickly enveloped in this glutinous varnish, and so tightly glued down to the hive-board, that the gases of putrefactive origin could not escape, and, in all probability, putrefaction itself would be long before it could commence, in consequence of the exclusion of atmospheric air. It were difficult to select instances of insect instinct more striking than these.

We need not multiply examples of instinct by reference to the proceedings of the bees, or even to those of the ants, which are little less

surprising, but which will have been amply illustrated in the preceding chapters. Let us, therefore, take some individual examples of instinct, which we shall find to fall little short of the ingenuity of some of the actions of our friends—the bees and ants. Messrs. Kirby and Spence state that a dung-beetle, which has the instinct to envelope its eggs in a pellet of manure, which it rolls for this purpose until it is sufficiently round to please the insect, when it can meet with the excrement of sheep abandons its rolling propensities as unnecessary, and in the pellets ready formed, deposits the germ of its future young. In this case the beetle evidently perceives that the work is done to hand, and makes no attempt to perform an operation, which, under other circumstances, it proceeds to do without hesitation.

The preliminary operation of the larvæ of many butterflies in spinning a sort of silken mesh or web, which is fastened to the wall, in order to attach themselves to, while undergoing the change from larva to pupa, and subsequently, has been described in the first part of this work. Mr. Spence, however, states that the larva of

a common cabbage butterfly, in a box covered with a piece of muslin, did not spin this preparatory web. The insect seemed to be aware that the muslin would do equally well for its attachment, and it accordingly fixed itself to this material and so underwent its regular changes.

Dr. Darwin informs us, that walking one day in his garden, he perceived a wasp upon the gravel-walk with a large fly nearly as big as itself, which it had caught. Kneeling down he distinctly saw it cut off the head and abdomen, and then taking up, with its feet, the trunk, or middle portion of the body, to which the wings remained attached, fly away. But a breeze of wind, acting upon the wings of the fly, turned the wasp round with its burden, and impeded its progress. Upon this it alighted again upon the gravel-walk, deliberately sawed off first one wing and then the other, and having thus removed the cause of its embarrassment, flew off with its booty. From this fact he was led to believe that the insect really reasoned about the difficulty with which it met, and adopted the wisest course to remove it.

But from some observations of Mr. New-

port's, it appears that this is only its usual habit upon every similar occasion. In September 1834, Mr. N. had an opportunity of observing the predaceous habits of the wasps in a large garden in which there was a numerous colony. The common white butterflies were exceedingly abundant, and the wasps were flying about very actively. On a sudden, a specimen of one of these butterflies, toward which he was looking, was precipitated to the ground from the thistle-blossom upon which it had been very quietly seated; and, upon going up to it immediately, he found a wasp very busily employed in cutting off its wings and head, and afterwards its legs. When it had done this, it took up the dismembered body, and poising it between its own legs, flew away with it to a neighbouring tree; where, upon following it, it was found mangling the body of its prey, as if to destroy the little remaining vitality. While doing this, the wasp had suspended himself upon a leaf by the claw of one leg which supported its whole weight, while its other limbs were employed in holding and turning the mangled body of the butterfly. When it had done this sufficiently, the wasp

rolled up the body between its second and third pairs of legs, and poising itself upon its wings, flew away towards its nest. During the same morning several similar opportunities of observing the conduct of the wasps presented themselves, and their mode of capturing and subsequent treatment of the prey were always the same. "From these facts," adds Mr. Newport, "I am induced to believe that Dr. Darwin's opinion respecting the existence of a reasoning power in insects, as deduced from the fact he observed, was too hastily formed, and that instead of its proving this, it shows us that insects have an unerring instinct, very similar to, but perfectly distinct from, reason; and that this instinct prompts them always to act in the same manner."

Insects frequently exhibit much intelligence in disposing of their prey after they have destroyed it. The memorable battle between the warrior wasp and the kakerlac described in the first part of this work may be recalled. It was there mentioned that when the victorious warrior had dragged the huge carcase of its conquered foe to the entrance of its dwelling, the body of

the latter was too large to go in at the wasp's street-door. In this emergency the wasp, rushing out, cut off the limbs of its victim, and after so doing was enabled to drag it into its cave.

The following account of the proceedings of a minute larva, of herculean strength and indomitable courage, will exhibit the same ingenuity manifested in a different way. "Walking one evening," writes a correspondent of the *Zoologist*, "in my garden, my attention was arrested by an earthworm upon the surface of the soil, turning itself from side to side in a strange unwonted manner. I immediately saw that something was wrong with the poor animal, and that it was in fact in the agony of death, but from what cause I did not at first discover. Presently a little black larva, about half an inch long, which had been couched quietly near the worm, ran to it, and bit it near the head. This had the effect of increasing the agonized writhing of the worm. The same thing was repeated several times, until the motions of the dying animal became less violent. The aggressor then commenced a survey of the surrounding ground, prying into every little hole within a circle of

nine or ten inches radius, sometimes disappearing entirely underneath the surface for a few moments. At length it appeared to have found one every way suitable to its purposes, situated a short distance from its victim. The larva then commenced dragging the worm head foremost towards the hole. But a small lump of earth lay between these, and to have dragged the worm round this would have materially increased the resistance. It overcame the difficulty by laying fast hold of the mandibles some little distance from the head, and *lifting it over* the obstacle. The body being now nearly in a straight line with the hole, it again seized hold of the head, and dragged it by little and little until it came to the mouth of the hole (which was an old worm-burrow); it then commenced pulling it in until all but about half an inch of the worm had disappeared, which was in about a quarter of an hour from my first seeing them. When it had got to this point of the operation, I dug up both the destroyer and his victim, and carried them forthwith to an accurate balance, where they were weighed, and the worm was found to weigh eighteen grains, the

larva not quite one!" There are in this fact two things worthy of notice: the surprising muscular strength of the courageous larva, which was as if one man were to drag eighteen or twenty others all tied together, for the distance of a hundred yards over broken ground; and the ingenuity it displayed in lifting the body over the obstacle, and in the selection of a subterranean cavern sufficiently large to accommodate the carcase of its victim.

Sir Joseph Banks relates a singular instance of a sort of change of instinct in a spider, which happened to have been mutilated. As he was writing at Spring Grove, a spider of the web-spinning species, of more than the middle size, passed over some papers on the table holding a fly in its mouth. Much surprised to see a spider of this description walking about with its prey, and struck with somewhat unusual in the gait of the animal, he caught it and placed it in a glass for examination. On so doing he perceived that it had lost five of its legs, which accounted for the inability of the creature to spin a web. The curious circumstance of its having changed its usual habits,

and having become a hunting spider instead of a spinning one, as well as a wish to learn whether its legs would be reproduced, induced him to preserve the creature, and to observe its conduct. Soon after its confinement, during which it was regularly fed with flies, the cripple attempted to form a web on the side of the vessel, but performed the task very slowly and clumsily. In about a fortnight it had completed a very small web on which it generally sat. In time its lost limbs were reproduced, but were shorter than the others, and the creature was then able to form a tolerable web, in which it seated itself, resuming its old habits.

Reviewing these indications of the intelligence, skill, and adaptation to circumstances displayed by insects, we cannot fail to be struck with the closeness of their resemblance to those actions, which in man flow from the impulse of reason, and power of thought. There is this great difference between the actions of man and those of these wise little creatures: that those of man are directed by a faculty linked with his immortal being, and that in man this faculty — or reason — grows gradually more and more

perfect according to the culture bestowed upon it. The insect is the creature of a day,—its allotted period spent, it returns to nothingness; and in the insect, its knowledge, intelligence, or instinct, its skill and every faculty with which the great and glorious Maker of the world has endowed it, are generally perfect at once. It learns little or nothing from experience, and in old age is no wiser than in youth. Let us however leave these difficult and abstruse subjects, for the more enchanting paths of real insect history.





CHAPTER X. — INSECT RAPINE.

CHAPTER X.

INSECT RAPINE.

IN endeavouring to present a faithful account of the habits and manners of insects, their food, and means of procuring it, must not be omitted. The battle-field, the scene of single combat do not present us with a view of insects in their expeditions for food, and though we have again to return to scenes of bloodshed and of mortal strife, the particulars connected therewith amply justify us in so doing, and the reader will doubtless find matter of wonder and interest in our relations concerning insect rapine. In the first part of our *Life of an Insect*, and in the details of larva voracity there entered into, sufficient account has been given of the vegetable food of insects. Our present chapter will therefore be confined to those subjects coming strictly under the title—insect rapine.

It may be learned with surprise by some of

our fox-hunters, that there are insects which hunt too. One of the most common of these may be observed by any one who in summer will hunt for *it*, on walls and window-sills, or in old gardens. This is the hunting spider. During the summer of last year one of these little creatures, an active, brown and white-spotted fellow, with an awful-looking pair of jaws, lay a captive in a glass jar on the writer's table. Never was such an agile hunter as he. A house-fly was introduced into the jar,—instantly our hunter was on the alert. Lifting up his head to take a good observation of his victim, which was unconsciously crawling up the glassy prison wall, he prepared himself for the pursuit. The fly stopped. The wary hunter crept slowly up the side of the jar, every now and then stopping to observe whether his approach was perceived or not. Moving stealthily upwards, he reached a height superior to that occupied by the poor fly, but at some distance from it. He then crept round the side until he had gained a position exactly over the fly's head, and above it, at the length of about two inches and a half. All this time

the fly was busy cleaning itself with great diligence, evidently in total ignorance of the proximity of so formidable and crafty a foe. The spider began to move slowly downwards to its victim. It was really a curious spectacle now to watch its approach. Raising one leg at a time, it crept downwards like an animal of the feline tribe, until at a distance from the fly which it judged to be within its power of leaping. Taking the precaution to attach itself by a thread to the side of the jar, it prepared itself to spring upon the heedless insect below. Swift as an arrow from the bow the spider leapt towards the fly, the latter had just sprang into the air, and the hunter caught it in his cruel grasp while on the wing! Now he experienced the value of his precaution in securing himself by the rope. The fly struggled violently in his embrace, and both insects whirled about in the air. But there was no escape from those relentless jaws, and the strugglings of the captive became gradually feebler and more feeble, until they finally ceased, the victor climbing up his rope end at his leisure, and sucking the life-juices of his prey. This spider did not hesi-

tate to attack large flies. Sometimes it missed its aim, and then slunk away as if ashamed. It was afraid of a blue-bottle fly, and ran away in trepidation before it.

In the pages of an old writer, William Bartram, on the natural history of the Floridas, an account is given of a hunting spider in terms more vivid than we can pretend to. "As I was gathering," says our author, "specimens of flowers from the shrubs, I was greatly surprised by the sudden appearance of a remarkably large spider on a leaf. At sight of me he boldly faced about, and raised himself up as if ready to spring upon me. His body was about the size of a pigeon's egg, of a buff colour; and together with his legs, was covered with short silky hair: on the top of his abdomen was a round red spot encircled with black. After I had recovered from the surprise, and seeing that the wary hunter had retired under cover, I drew near again, and presently discovered that I had disturbed him on a predatory expedition against the insect tribes. I was therefore determined to watch his proceedings. I soon observed that the object of his wishes was a large

fat humble-bee, that was visiting the flowers, and piercing the nectariferous tubes. The cunning, intrepid hunter concealed his approaches with the circumspection and perseverance of a Siminole when hunting a deer, advancing with slow steps obliquely, and under cover of dense foliage, and behind the limbs; and when the bee was engaged in probing the flowers, he would leap nearer, and again retire instantly out of sight under a leaf, or behind a branch, at the same time keeping a sharp eye on me. When he had gotten within two feet of his prey, and the bee was intent in sipping the delicious nectar of the flower, with his back next the spider, he instantly sprang upon him, grasping him over the back and shoulders, and both disappeared. I expected the bee had carried off the spider, but I soon saw them both together suspended by a strong elastic thread which the spider had fixed to the bough, from which he leaped to the bee. The rapidity of the bee's wing, as he endeavoured to extricate himself, made them both together look like a moving vapour, until the bee became wearied with whirling. In a quarter of an hour he was completely exhausted

by his struggles and the wounds of the butcher, became motionless, and expired in the arms of the devouring spider, who ascending the rope with his game, retired to feast on it under cover of the leaves."

The spiders present us with perfect types of the hunting propensities in other animals. Cunning, fierce, and strong, woe to the luckless insect that falls in their way! Sometimes they conceal themselves in a flowery cave all hid with enshrouding leaves, or surrounding petals. Here the wary insect lies concealed, awaiting the passing by of some heedless traveller. A giddy fly comes seeking honey in the neighbouring flower, and in an instant finds itself locked in the deadly gripe of the secreted murderer, who pounces upon his victim with the swiftness of thought, and the utmost precision of aim. Others, still more artful, actually pretend to be dead, and lie prostrate with moveless limb, until the prey draws sufficiently near to be seized, when they start up, and the victim's fate becomes sealed.

The Rev. Mr. Sheppard, say Messrs. Kirby and Spence, has often noticed in the fen ditches

of Norfolk, a very large spider which actually forms a *raft* for the purpose of obtaining its prey with more facility. Keeping its station upon a ball of weeds about three inches in diameter, probably held together by silken cords, it is wafted along the surface of the water upon this floating island, which it quits the moment it sees a drowning insect; not, as we might conceive, for the sake of applying to it the process of the Humane Society, but of hastening its exit by a more speedy engine of destruction. The booty thus seized, the pirate devours at leisure upon its raft, under which it retires when alarmed by any danger. Other spiders hunt along the edges of the pools, and now and then they chase their prey upon the glassy surface of the water itself. We need not allude to the well-known stratagem of the web, of itself one of the most beautiful of structures, and ingenious in stratagem.

Long since, Madame Merian, in her work on the insects of Surinam, gave an account of a gigantic spider which destroyed and devoured small birds. Much doubt upon this relation existed for a length of time; Madame Merian's

statements were so often incorrect, that the account was looked upon as entirely fabulous. She gave an engraving of a monstrous spider in the very act of murdering a bird which was smaller than itself. It appears, however, that the statement was not altogether incorrect as to the murderous propensities of a species of great spiders.

In the Journal of the Asiatic Society of Bengal, an interesting communication on this subject is given by Captain Thomas Hutton. The spider he calls by the appropriate name — *Galeodes vorax*. He says its usual size is about from $2\frac{1}{2}$ to $2\frac{3}{4}$ inches in length, and the body is equal to a thrush's egg. The head is armed with two strong and formidable double jaws, the ends sharp-pointed, and extremely hard and horny. In seizing its prey one pair of jaws keeps hold, while the other is advanced to cut, and they thus alternately advance, and hold, till the victim is sawed in two.

“My first observations on this species,” writes Captain Hutton, “were made in 1832 at Mirzapore, where it is very abundant, and of a large size. During the rainy season, it was my constant

habit, on a fine evening, to spread a sheet upon the ground near my house, upon which was placed a lantern to attract insects." The spiders seemed to value this device as much as our entomologist. Two or three of these ravenous creatures would make their appearance at the edge of the sheet, but at a respectful distance from each other, and no sooner did a moth, or a beetle, or a cricket alight upon the sheet, than it was instantly snapped up and devoured by one or other of them. There seemed, indeed, to be no end to the appetite of these creatures, for they continued to seize and devour everything indiscriminately that came within their reach, even to large and hard-winged beetles, cutting them to pieces with their powerful jaws with the greatest ease.

"Many were the deadly fights," observes our author, "I witnessed among these marauders as they trespassed on each other's beats to get possession of some newly alighted prey, and often was I obliged to kill them, in order that I too, might in turn obtain some of the booty." These voracious monsters, like many predacious animals, roam about at night in search of food,

living in the day beneath stones, and in holes in the ground. Captain Hutton kept one of these fierce creatures in a vessel, the bottom of which was well supplied with earth. It soon began to dig a hole, and in a very short time succeeded in making itself a subterranean retreat, in which it usually resided, seldom coming forth beyond the mouth of its den. It proceeded to dig out the earth at first with its strong jaws, cutting it away in a circle, and having thus loosened the soil, it gathered it together into a heap with its anterior palpi, and threw it out behind, as a dog does in scratching a hole. It turned out that this specimen was a female, and in due time it was surrounded by about fifty young ones. It was deeply interesting to watch the insect parent at this season. From the general bad and ferocious character of the creature, we might have expected that she would, at the first craving of appetite, have fallen upon her helpless young ones. But the all-wise and benevolent Creator has endowed even this fierce and sanguinary creature with that most powerful feeling, maternal love, and the very tiger of the insect world became at

this time subdued into the anxious and tender mother.

Placing herself in the front of the aperture of the cave, she kept watch over her infant family, and, like a careful sentinel, suffered no living creature to enter her cave, without first examining it with the utmost caution. Straws were thrust in, on the supposition that she might be aroused to anger, and turn upon her young, and devour them. But all in vain; though she bit at the straws in evident anger, not once did she injure her own offspring, which were fondly crawling over her. Some beetles and flies were thrown in, and instantly were swallowed up. Two or three of her own young ones were then thrown before her with a beetle or two, thinking to deceive her, and make her, in the blindness of her fury, commit infanticide. But she was not to be thus deceived. The unfortunate beetles were instantly seized and devoured. But the mother knew her own offspring, and drew them into her den without the slightest injury.

Yet this same tender parent when her family was all dispersed, resumed her ferocity of dis-

position, and voraciousness of appetite. A lizard three inches long, exclusive of its tail, was entirely devoured. The spider leapt upon it, seized it immediately behind the shoulder, and never quitted its hold till the whole was consumed. The poor animal struggled violently at first, rolling over and over in agony, but the spider kept firm hold, and gradually sawed away with its double jaws into the very entrails of its victim. After this meal, the voracious destroyer remained gorged and swollen for a fortnight. A young sparrow, about half grown, was placed under a bell glass with the spider. The moment the luckless bird moved, the spider seized him by the thigh, which he speedily sawed off, in spite of the sparrow's fluttering, and then, as the poor bird continued to struggle in pain, the savage spider seized him by the throat, and soon put an end to his sufferings by cutting off his head. It did not, however, devour the bird, nor any part of it, but seemed satisfied with having killed it. Two young musk rats were confined with one of these large spiders, and were both killed by it.

M. Moreau de Jonnes relates of a large spider

common in the Island of Martinique, that it chases far and wide in search of its prey, and conceals itself beneath leaves for the purpose of surprising it, and will climb the branches of trees to devour the young of the humming-bird. This spider is said to throw itself upon its prey, to cling to the body by means of the double hooks with which the ends of its feet are furnished, and it then strives to reach the head, that it may insert its fangs between the skull and front bone of the neck. Its obstinacy and ferocity in fighting and hunting cease only with its life.

Mr. Macleay states that he found in some woods near Sydney in Australia, a young bird suspended in the web of an enormous spider. It was already half eaten, he observes, and the spider was in the act of sucking its juices. And in Percival's account of Ceylon, it is recorded that there is in that island an immense spider, the legs of which are not less than four inches long; its body being covered with thick black hair. The webs this spider is said to construct, are strong enough to entangle and hold even small birds, which are said to form its usual prey.

The driver ants, of whom mention was made at an earlier part of this volume, are a nation of insects which live by rapine, and for such a mode of existence are well calculated by the ferocity of their character, and the formidable nature of their attacks. The author, from whom the former account of their proceedings when emigrating was taken, gives us the following description of them. "The head of one of the largest class, when dissevered from the body, grasped the finger of an attendant so furiously as to cause an immediate flow of blood. It was kept in a glass tumbler from 3 P.M. till the next morning at eight o'clock, when the finger was again applied, and apparently as severe a wound as before inflicted. Another individual of the same class was decapitated at 7 A.M., and at half past nine the next morning,—26½ hours from the time of decapitation, a piece of newspaper was held between the jaws, which it grasped and retained with considerable force. Dr. Savage then applied the small finger of his right hand, which it bit severely; indeed, so powerful was the grasp, that the point of the mandibles met beneath the cuticle. It then

partly withdrew one mandible, and pointing it more perpendicularly, penetrated deeper, then the other, and thus at every alternate stroke giving to the mandible a direction more vertical, wounding and cutting wider and deeper, precisely in the manner of the insect in possession of all its parts and powers. The sensation at each thrust was like that of a pin, and equally painful; and when the mandibles were withdrawn the blood flowed as freely. This head continued to give signs of life for more than thirty-six hours after decapitation. The body to which it belonged lived still longer,—more than forty-eight hours. No insect can be more ferocious and determined upon victory. They fiercely attack anything that comes in their way,—“conquer or die” is their motto. When a live coal of fire has been held before them, though so obnoxious to heat, they rushed at it with indescribable ferocity, releasing their hold, only in death. Woe to the luckless being opposed to warriors so redoubtable and obstinate as these!

In order to see what they would do with it, a dead fowl was placed near their dwelling, and they were roused several times by knocking on

the covering of their habitation. This brought them forth in large numbers, when they ran about in different directions in search of the intruder, coming very near to their favourite food, but not one falling in contact with it. The bird was now brought within two, then one foot of their nest, both times with the same success. At last one or two, as if by accident, found it out, and laid hold of the feathers in a great rage, then retired within their habitation. The observer waited a long time to see if any intelligence would be conveyed of the proximity of their favourite prey, but no evidence of the fact appeared. They were then roused again, and some of the largest of the second class were put upon the bird. They jumped about in great perturbation and rage, pulled vigorously at the feathers, then biting into the flesh at last disappeared without further effort. No intelligence being as yet conveyed that food was at hand, they were brought forth in still greater numbers and the fowl being thrust down amongst them, was held there till it was well covered, and then withdrawn to a distance of about two feet, to observe their proceedings. As the fowl was

drawn back many ants were left on the intervening ground, and thus free communication was soon established between it and their domicile. A few of the largest class, which are always the first to come forth for defence, were seen running to and fro, forming a line which, when completed, was seen to be composed mostly of individuals of classes numbers two and three, number one evidently taking management of the others. The first step in their operations was to clear the path of all moveable obstructions. This was done chiefly by the third class; some of number two, and occasionally number one, coming in when large obstacles were to be removed. It was intensely interesting to see these little creatures gaining victory, by one process after another, over comparatively mountainous obstacles in their way; greater difficulties only rousing them to greater effort. Here would be seen one dragging along a stick four times its length; there, another, pushing, then grasping and pulling along a stone many times its weight; and, when more power was requisite, others coming in to his aid, all knowing that a work was to be performed, and each doing

promptly his part. Thus were stones, sticks, leaves, and grass, successively withdrawn from within their line, and deposited at a distance from the scene of their labours. A regular, distinct footpath was soon made visible, and in readiness for the quick transportation of their prey. In the meantime the largest, with an equal number of the second size, were busily engaged upon the head of the fowl, depriving it of its feathers. This promised to be a slow and tedious operation; but the gradual increase of feathers, and the denuded skin, were sure indications of their success. The feathers were pulled out; sometimes one, two, and three ants would be seen tugging most lustily at one, but the largest feathers appeared to be extracted by lacerating the flesh at their root, though this point could not be fully decided. Those that fell in the way were borne off by the smaller ants; others were made to answer as a covering to their pathway, being held together by the largest size, or soldiers. The operation of picking began at the beak, and was gradually extended backward. The neck being half stripped, they then began the work of laceration at the

eyes and ears. It was some time before any visible impression was made, but at last, though by no means so expeditiously as might have been expected, deep cavities appeared, and muscles, membranes and tendons were reduced and borne off to their habitation. The juices, and a portion of the muscular fibre, appear to be consumed on the spot at such times, though the largest portion is carried to their domicile.

At first there was considerable confusion in the lines. They seemed to be incapable of keeping the right path, and even missed the various entrances to their domicile. Individuals of the largest class were seen to arrange themselves on either side, between whom the lines of works passed and repassed with a good degree of order. These were acting evidently the part of guides rather than guards, though at times they acted in the latter capacity also. They would place their abdomen horizontally on the ground, and laying hold of fixed points with their hind feet (which together thus acted as a fulcrum), elevate the anterior portion of their bodies to the highest point, open wide their jaws, and stretch forth their antennæ, which for the most part were

fixed, as if in the act of listening and watching for approaching danger. They would occasionally drop their bodies to the ground again, run off to one side, and fiercely work their jaws and antennæ, as if having detected some strange sounds in the distance! Discerning nothing, they would quickly return to their posts and resume their positions, thus acting as scouts. Ultimately the fowl was stolen by some of Dr. Savage's covetous, perhaps hungry parishioners, who excused the act of aggression by saying that the Drivers were their most grievous enemies, often depriving them of the two things they most loved,—poultry and sleep; and that he was entertaining them with undue hospitality; others more jokingly said, that he was making them his Fetish, and offering to them sacrifices of birds and fowls. We may feel truly thankful that such robbers and devourers are unknown in our own favoured land.

What a life of cruelty and rapine is that of the murderous but cowardly Mantis! Espying an unhappy fly, this murderer, which sits with its body half raised,* forming its two fore feet

* See Frontispiece to this Chapter.

as if it were praying, whence its name "the praying insect," fixes its bright green eye upon it, following its minutest movements. Slowly approaching, it stretches itself as near as possible to the fly, and suddenly its long feet are thrown upon the victim swift as lightning. The poor insect, held in the deadly embrace of the mantis, is now mangled and devoured limb by limb. The mantis will even attack lizards. An observer in North Carolina, states in a letter to Dr. Erichson that several active newts were placed before one of these insects. One newt after the other was seized, and to a greater or less extent devoured. In vain did they endeavour by rapid contortions of the body and blows with the tail, to elude the grasp of the mantis, which, with the head depressed and the hinder part of the body tilted upwards, kept a firm hold of its victim, and ate until it could eat no more. Whenever a mantis seizes another insect or small animal, the anterior extremities are brought down to below the level of the head, so as to avoid having to sustain the weight of the prey.

The hornet amongst ourselves, though less cunning, is not less ferocious than the mantis,

as may be conceived from the account given us by Mr. Knapp:—"This year (1826) the hornet (*Vespa crabro*) abounded with us in unusual numbers, and afforded constant evidence of its power and voracity, that could not have been exceeded by any ravenous beast. In our gardens the imperious murmur of four or five of them at a time might be frequently heard about our fruit-trees. They would occasionally extract the sweet liquor from the gage, or other rich plums; but the prime object of their visit was to seize the wasps that frequented the same places. This they not only did when the creature was feeding on the fruit, but would hawk after them when on the wing, capture them with a facility to which their heavy flight seemed unequal; bear them to some neighbouring plant, and there feed on the insect, which seemed perfectly overpowered by the might of the hornet. The first operation was to snip off the head, then to cut away the lower part of the waist; and, when near, we could hear them shearing away the outer coat from the body, and crushing it with their strong mandibles; sometimes devouring it, but generally only sucking the juices it contained. Their avidity for this

sort of food is very manifest when the grape ripens on the wall,—being commonly the only remaining fruit, the wasp abounds there; the hornets flock to the prey, and we may see them in constant progress, bearing their victims from the bunches.”*

The quiet regions of the brook and pool display scenes of insect rapine and violence, not less than the smiling and apparently peaceful fields and gardens, or the still forest and woodland. Of these we shall only select one, and that the account given us by the same author, of the proceedings of the ferocious water-beetle:— Another of the ravenous creatures that infest our pools is the great water-beetle (*Ditiscus marginalis*); and perhaps it is the most ferocious of any of them, being adapted by every provision for a life of rapine, endued with great muscular power, armed with a thick and horny case over its body, and having its eyes large to observe all the creatures about it, and powerful mandibles to seize and reduce them to fragments. It riots the Polyphemus of the pool; and having thinned its herd in one place is supplied with wings, to effect a removal to a fold better furnished. It even

* Journal of a Naturalist, p. 323.

eats the young of the frog; and its bite is so powerful, as to be painfully felt by the hand that holds it a captive, though defended by a glove. In the larva state it is almost equally destructive, it swims admirably, its hinder legs are long and brawny, besides being aided by a fringe of hairs, so that they are powerful oars to propel its body with celerity and ease. Nor must we omit a peculiarity attending the constitution of this beetle which marks it as a creature especially endowed for the station in which it is placed. Multitudes of insects exist in the larva state for a certain space of time in water, and, having accomplished a given period in this state, perfecting their forms, they take wing, and become aërial creatures, after which a return to the element whence they sprang would be death to them. But this beetle, when it has passed from the larva state, and obtained its wings, still lives in that water which nourished it to this stage of perfection, without any inconvenience, as long as it suits its inclination; when weary of this place, or its food becoming scarce, it wings its way to another pool, into which it immediately plunges, and recommences its life of rapine.

How varied are the means, and stratagems by which the carnivorous insects are supplied with food! What a picture of nature at war is presented to us in this chapter, where we have seen one occupant of our fair creation derive its food and maintain its existence by waging a perpetual warfare upon others. Well may earth be called the “deathful earth.” Although all these scenes of rapine and bloodshed are well ordered, and form a part of the great plan of creation as it now is, the mind, seeking after peace, longs for the time when the reign of peace promised in the Word of God shall be established over our groaning and bleeding world, and when Jesus, the Prince of Peace, shall reign King of kings, with them that love and believe in Him, over a renewed and liberated creation.

CHAPTER XI.

INSECT MISCELLANIES.

MUCH yet remains to be said about insects. The more we study the lives of these interesting beings, the more we become filled with wonder at their proceedings, and the more time and space seem to be required to set forth their history in all its striking details. Time and space would fail ere all that could be recounted of them, their characters and their doings deserving our notice, could be told. Let us, therefore, occupy the space that is yet left to us with a miscellaneous collection of interesting particulars about insects, previously to our taking the reader to the closing scene.

In so doing let us say a few words upon insect affection. Our intelligent little friends, the ants and bees, supply us with the most striking evidences that these humble beings appear fully sensible to a degree of that tender



feeling which, in ourselves, we call affection, and may, therefore, apply it to them. In the "Annals of Natural History" a correspondent relates the following anecdote of some ants. In a colony of black ants, the queen, from some cause or other, died, and her royal body lay stiff and cold in one of the passages of the formicary,—but not deserted in her death. Some insects constantly attended her remains, occasionally tenderly touching the inanimate body of their monarch with their antennæ, and with their heads slightly thrusting her, as if to bid her awake. But there was no answering movement in her lifeless limbs, and, to their surprise, the body still remained stiffened and immovable. A little water was dropped upon these faithful watchers. Generally a drop of this fluid causes ants to disperse and run away, but, in this instance, although it threw them into some confusion, they refused to forsake their queen, and remained still on guard.

The affection of bees towards their queen is strikingly depicted in a circumstance which fell under the observation of Dr. Evans, to which allusion will be made in the next chapter.

These insects also regard one another with a sort of affection, and are, on many occasions, helpful to each other when a time of accident or peril arrives. Nor less so are the ants. In both of these social insects the feeling of affection for the young is particularly manifested. Where shall we find such nurses as the ants, who, as we have before said, wash their little charges, though not their own offspring, keep them as white and clean as possible, carry them out into the sunshine, bury them in the warmest covers from the frost, feed them in their helpless hours, and think no trouble too great, no task too arduous to undertake for their welfare? The wasps, in the period of their infancy, are the subjects of equally affectionate cares, on the part of a tender mother. When they are hatched it is most amusing to see the bustling parent running from cell to cell, popping her head now into this, now into that little bedroom, to see that all her numerous children are safe, thriving, and supplied with food, which she unweariedly carries to them. Even if the nest is broken to pieces, the mothers of the colony will not

abandon their helpless young ones, lying dead and dying on the cold ground. Huber tells us of some humble-bees, whose affection to their young, and consideration for each other, might serve as a pattern to higher beings than themselves. They had been placed under a bell-glass, with a piece of comb, containing young, of such a shape as to stand very tottering. Their affection for their imprisoned young, led them to mount the comb for the sake of imparting warmth to the inclosed little ones, but in so doing it tottered so violently as to render the scheme almost impracticable. Perceiving this, two or three mounted on it, stretched themselves over the edge, and with their heads downwards, fixed their fore feet upon the table, so propping it firmly up. In this constrained and painful posture, fresh bees relieving their comrades when weary, did these affectionate little insects support the comb for nearly three days. At the end of this period they had prepared a sufficiency of wax with which they built pillars that kept it in a firm position.

But if insects are capable of a sort of affection, so are they also of the passion of anger.

Virgil has spoken much of the irascibility of bees. When a bee is angry her tone of buzzing alters, and becomes shrill and piercing, and then let the offender beware of the weapon with which our insect is armed. Humble-bees, when disturbed, and put out of their way, show their irascibility in a very odd manner. The insect, when threatened, assumes almost the attitude of a pugilist. It lifts up two or three of its legs, turns upon its back, and thrusts out its glittering weapon, accompanied with a drop of venom. Sometimes the poison is actually spurted forth in its anger. The hive-bee is accurately described by Shakspeare to "threat before she stings," the threat being the scolding, querulous, and half-angry tone with which she salutes the offender. Mr. Knight says of the bee, that she is angry only when near home; her feelings of patriotism being then, perhaps, most alive.

Another circumstance, well deserving notice, about insects generally, is the scrupulous cleanliness of their habits. Frequently insects which drink the "honey all the day from every opening flower," get themselves covered all over with the yellow pollen dust, which sticks to their little

hairy bodies, and gives them the most ludicrous appearance. Oftentimes the flies which frequent the golden sunflower, in feasting upon the honey locked in its yellow recesses, get themselves covered all over with this yellow powder, and are as dusty as millers. It is now most amusing to see their operations. The hind legs are employed to clean the wings and abdomen, and the fore-legs the head and thorax. The pollen is brushed off the head, eyes, and face, and then rolled up into pellets by the fore-legs, and thrown away with a kind of jerk. The common blue-bottle fly may be seen going through the same proceeding while resting on some sunshiny wall. How carefully he brushes himself from head to foot, sweeping over his body in all directions, until not a particle of dust is left behind. The common house-fly may also be frequently observed pluming itself with similar carefulness. This insect has an important task to fulfil in cleaning the minute brush-like extremities of its feet. It is supposed, by Mr. Blackwall, that the tiny hairs which form these brushes, or *pulvilli*, secrete a sort of glutinous fluid, which enables the insect to walk upon

the ceiling, or up a window-pane. The action of rubbing its feet together, much as we do our hands in washing, is supposed, by Mr. Spence, to be intended to keep these little brushes clean, and free from any particles which might prevent their sticking to the wall. Mr. Spence says, in an article read before the Entomological Society,* “I have repeatedly seen flies, after rubbing together their two fore tarsi and pulvilli, put down, on the surface on which they were standing, first one of the pulvilli, and then the other, and pull at each, as if trying if they would adhere properly.” Bees are particular to a degree as to the cleanliness of their habitation, on no account suffering excrementitious matter to remain on the floor of the hive.

It is interesting, after all we have seen of the activity of the insect world, to inquire as to its periods of repose. During winter, when the earth is a barren desert to the insect world generally, insects spend the long months of that season, in one or other of their conditions, in a state of torpor, called hybernation. Spring awakens these slumberers, and their long motion-

* Transact. Entom. Soc., vol. iv. p. 18.

less forms are seen disporting in the genial air of April and May. But insects sleep at shorter intervals also, and this is called their diurnal sleep. Their sleep, however, is not always at night. Many insects appear only during the hours of darkness. When the air is still, the evening warm, and the moonshine flies from tree to tree, gleams on the river, and bathes the meadow with its chastened light—then is the sporting-time for numbers of beautiful insects, belonging to the tribe of moths. The flowers in garden, field, and woodland, are surrounded by pale, noiseless flutterers, and while all nature beside seems asleep, these beautiful creatures come out like fairies to “dance in the light of the moon.” This tendency to come out only in the evening—imitated, alas! by many who turn night into day, and waste the hours indicated by nature for repose, in the flutter of the assembly-room—is taken advantage of by the wary collector to entrap the evening sporters. Others again, busy all day long, take their rest at night. Of these are the hard-working bees, which, as regularly as evening shades close on them, muster in silence for the purpose of repose. Huber seems to think

that even in the middle of the day bees now and then, wearied by over exertion, take a short nap. In so doing they insert half their bodies into an empty cell, and remain there, without motion, for half an hour, or longer.

The inspired writer has said "Every kind of beasts, and of birds, and of serpents, and of things in the sea is tamed, and hath been tamed of mankind."* Although insects are not expressed in this statement, they are not excepted; and it is a curious fact in their history, that these minute creatures have really been tamed by man. The anecdote of the stag-beetle related in a former page, is a case in point, but there exist yet more remarkable illustrations. Mr. Lukis, in an article in Loudon's "Magazine of Natural History," gives a singular account of some familiarities which he effected with some butterflies in his garden. The butterflies were busily engaged in feeding on a green-gage, and appeared unusually tame. On the approach of the finger they did not fly away, but gently flapped it with their wings. They even submitted to being stroked with a feather.

* James iii. 7.

These familiar feats were repeated many times. One of the insects would walk over the face, insert its proboscis between the lips, fly away, and return again to the face or clothes. Several insects of different species became also tame by a little management. Mr. Couch has related the same observations with regard to a species of butterfly which was so tame as to feed on fruit held in the hand, and to allow themselves to be taken up between the fingers.

The most remarkable, and even ludicrous instance of the kind, is the taming of fleas. These little insects, subdued by the patience of their keeper in an extraordinary degree, long formed one of the public exhibitions in the metropolis. In the room where they were shown, was a table covered with green cloth, on which several tiny tables were arranged, six or seven inches square, and covered with white paper. Upon these the fleas went through their feats. The little insects were exhibited all harnessed with silk harness, dragging along a coach; the coachman was a flea, and brandished a whip, and the guard also was a flea, who every now and then put a mimic silver trumpet to his mouth! Others were shown

with paper figures of several martial heroes on their backs. Other fleas were taught to ride a tournament at each other. Another danced with a blue petticoat, and drew up a golden bucket full of water from a tiny well. Others danced to music; some imitated the musicians. Altogether, the insects performed a variety of tricks which served to indicate their subjection to the ingenuity and perseverance of their proprietor. The manner in which these little beings were educated, we are unable to describe.

A celebrated French prisoner, M. Pelisson, having been confined in the Bastile, beguiled the hours of his imprisonment by endeavouring to tame the humble creatures which were his only companions in solitude. Being fond of music, he used to solace himself frequently with performing airs of various kinds, at which the spiders of his apartments testified their pleasure and interest by always coming forth, and retiring again when the tones of his instrument were silenced. A manufacturer in Paris is said to have tamed eight hundred spiders, which he kept in an apartment devoted to their use. Here he was accustomed to visit them, taking in his

hand a dish of flies. As soon as the spiders saw him appear, they all used to descend to partake of the repast he had furnished for them. These instances are sufficient to show that the dominion of man extends even over the world of insects, and that by patience and ingenuity he is occasionally able to subdue them to his will.

Perhaps the most remarkable instances of the adaptation by man of the industrial habits of the lower creatures to accomplish his own purposes, is the one we are about to relate. In 1827, M. Habenstreet of Munich communicated, through M. Le Normand, to the National Institute of France, the result of some singular experiments of his upon caterpillars. These caterpillars were the larvæ of a butterfly. In a natural state they construct a silken city similar to that described at an earlier part of this work. The texture of this material is extremely fine and thin, yet sufficiently close to be almost impervious to air. M. Habenstreet, taking advantage of the spinning instinct of these larvæ, made them work upon a paper model, to which he gave the form and dimensions which suited him. In order to give the tissue a regular form, it

was often necessary to fix limits beyond which the little weavers were not to go. This was ingeniously effected by touching certain parts of the model with oil, the larvæ refusing to work on all surfaces so treated. By various little contrivances, M. Habenstreet succeeded in making these insects weave for him various articles which almost presented the regularity of the same articles made by human hands. It was found by him that one or two insects could produce about one square inch of cloth. By causing the insects to go more than once over the same surface, this ingenious gentleman succeeded in making the cloth either finer or more dense. The fabric itself bore no resemblance to silken stuff, the filaments of which are interlaced, being much more compact, and homogeneous. It was as fine as the lightest gauze.

M. Habenstreet succeeded in making his insect operatives weave square shawls a yard and a quarter in size. Some were two yards and a half long, by one and a quarter broad. He also procured an air-tight balloon made by them, which was four feet high, and two in horizontal diameter. A professor of Chemistry, in the

university of Stockholm, actually beheld the insects at work! and saw this balloon. It only weighed five grains, nevertheless, it was described as being air-tight. The mere heat of the hand was sufficient to inflate it in an instant, and the flame of a single match held for some seconds beneath it, caused it to rise to a considerable height in the air, where it remained for half an hour. A shawl of a yard and a quarter square was blown into the air by a slight puff, and it then resembled a light vapour, gently agitated by the wind. M. Habenstreet offered jocosely to present this shawl to this gentleman on condition that the latter would cause it to fall from the air on his head! But to his mortification, he found this altogether impossible, for as the shawl approached his body, the heat of the body produced sufficient agitation in the air to keep the tantalizing fabric suspended above his head! It appears that M. Habenstreet must have got his insects to work for very low wages, for this exquisite shawl could be purchased for about 7*s.* 6*d.* The crowning work, however, of these ingenious insects was the fabrication of a complete dress without the sleeves, in which

there was no seam. This exquisite work of insect art was presented to the Queen of Bavaria, who, to show her gratitude to her zoological sempstresses, and to exhibit so rare a curiosity to the admiration of her suite, used to wear this beautiful robe over her dress on court days.

At the sitting of the French academy of science, in August, 1840, M. Lavasseur forwarded a piece of a very fine tissue, a kind of cloth made by caterpillars, which was found in Moravia. In the "Naturalist" for 1838, occurs the following passage also relative to our subject. "A most extraordinary species of manufacture has been contrived by an officer of engineers residing at Munich. It consists of *lace veils*, with open patterns in them, made entirely by caterpillars. The following is the mode of proceeding adopted:—Having made a paste of the leaves of the plant on which the species of caterpillar he employs feeds, he spreads it thinly over a stone or other flat substance of the required size. He then with a camel-hair pencil dipped in olive oil, draws the pattern he wishes the insects to leave open. This stone is placed in an inclined position, and a consider-

able number of caterpillars are placed at the bottom. A peculiar species is chosen, which spins a strong web. The animals commence at the bottom, eating and spinning their way up to the top, carefully avoiding every part touched by the oil, but devouring every other part of the paste." The extreme lightness of these veils, combined with some strength, is truly surprising. One of them measuring $26\frac{1}{2}$ by 17 inches weighed only one grain and a half! a degree of lightness which will appear more extraordinary when contrasted with other fabrics. One square yard of the substance of which one of these veils is made weighs $4\frac{1}{2}$ grains, whilst one square yard of silk gauze weighs 137 grains, and one square yard of the finest net weighs $262\frac{1}{2}$ grains. That such a manufacture can be carried on profitably is more than questionable; but if any of our readers are disposed to try it, they would succeed with a little tact if they employed the tapestry-making caterpillars, to whose operations we have before alluded.

The evolution of light is a remarkable attribute of some insects; and none who love to stroll by the country way-side, when the sun

has gone down, on some fine and genial summer evening, can fail to have noticed the sparklings of the glow-worm in the short grass on the bank-side. We are told by Waller, that

“The man who first upon the ground
A glowworm spied, supposing he had found
A moving diamond, a breathing stone ;
For life it had, and like these jewels shone,
He held it dear, till by the springing day
Informed, he threw the worthless worm away,”—

which was scarcely fair to those pretty but humble creatures. The lamp of the glow-worm is seated, not where the poet placed it, who wrote of lighting tapers “at the fiery glow-worm’s eye,” but at the extremity of the under-side of the abdomen of the female. It appears to consist of phosphorescent matter, secreted by some peculiar structure placed at the seat of the light. It is generally stated that, although the male insect is slightly luminous as well as the female, and the luminosity exists in the larva and pupa as well as in the imago state, the object of this light is in reality to attract the insects together,—

“To captivate her favourite fly
And tempt the rover through the dark.”

It is remarkable that the insect has the property of extinguishing the light at pleasure. Burmeister says, "This they appear to do in moments of danger, at least I have often observed that those which I have caught with my hat during flight, immediately ceased shining, and so frequently deceived me by my fancying that I had missed the creature: but I afterwards discovered it in my hat when it again shone."

In the presence, however, of some foreign luminous insect, the glow-worm must "pale his ineffectual fire." Mr. Edwards, in his voyage up the Amazon river, says that as night draws on, "Huge moths, those fairest of the insect-world, have taken the place of butterflies, and myriads of fire-flies never weary in their torch-like dance. Far down the road comes on a blaze, steady, streaming like a meteor. It whizzes past, and for an instant the space is illumined, and dewy jewels from the leaves throw back the radiance. It is the lantern-fly seeking what he himself knows best, by the fiery guide upon his head." In the West Indies, the evenings are rendered splendid in the extreme by the appearance of innumerable

fire-flies. As twilight dies away, all nature is illumined with these "stars of the earth, and diamonds of the night." At one step, says the Rev. Lansdown Guilding, you see some gigantic tree peopled by these magic rovers, glowing with all the green, the gold, and emerald lustre of precious stones. At another step, some long lane in the darkness of the night seems to have been consumed by fire, and to be throwing up its last expiring sparks. The insects, as they present their backs, conceal their floating lantern for a moment, and render the resemblance perfect. Presently, with a steady and bold sweeping course, the luminous *Elater* crosses your path,

"—A meteor swift and bright,
And the wide space around, on high,
Gleams with his emerald light."

It forms a strong contrast to the tantalizing phosphoric fires of the lesser stars, and resembles a wax taper borne rapidly through the gloom by some invisible hand, while the ear is assailed by countless tribes of sonorous insects, and frogs raising their nightly cries. How glorious is such a scene! From the innumerable

host of insects which light up the earth, and from their proximity to the eye of the spectator, they have all the brilliance of real stars. Above our heads is the broad firmament of stationary lights; below is a second firmament of luminous points, moving with all the eccentric courses of comets, and meteoric balls, and with all the glory that tracks the shooting stars.

The sportings of these beautifully adorned insects in the still and dark evenings in Jamaica are highly picturesque. Frequently one insect will be seen streaming down a valley, a moving point of greenish brilliance. After him follows another, and another, until a line of waning light lights up the dark ravine, and is presently lost in the distance. Again another torch-bearer leads the van, and is followed by another column of sparklers, flowing down like a floating line of jewels, and again lost in the distant darkness. In Hayti, we are told by Oviedo, that a luminous insect exists, called Cocuyo, which emits sufficient light to see to write or read by: and if one puts together four or five of these cocuyos, tying them together, they serve well as a tolerable lantern in the fields. When war was carrying

on in Hayti, the Christians and the Indians made one of these lights in order not to lose one another. The Indians strung them into necklaces, and were afar off conspicuous by their glittering collars. Thus, he quaintly remarks, both in the fields and houses, people by means of the light of the cocuyos, do whatsoever they need to do, without the breeze, or wind, or rain being able to put out their light. It was customary to keep these insects in confinement for domestic purposes, and feasts were made at which the only lights employed were those of these creatures. The Indians used to make a sort of paste of the bodies of these insects, and smear it over their faces to the terror of their companions.

In Kœmpfer's "History of Japan," we are told that luminous insects sometimes settle on trees like a fiery cloud, with this surprising circumstance, that a whole swarm of these insects having taken possession of the tree, and spread themselves over its branches, sometimes hide their light all at once, and a moment after make it appear again with the utmost regularity and exactness. How splendid a spectacle a tree

thus adorned, in the darkness of a tropical night ! The finest of all the fire-flies is one of incomparable beauty, and is kept by ladies among their curiosities. This insect is described as “about the length of a finger, with four wings, two of which are transparent, and hid under a pair of others, which are shining, as it were polished, and most curiously adorned with blue and golden lines and spots.” The Javanese say that all other night-flies fall in love with it ; and that to get rid of them, it maliciously, or for a trial of their constancy, bids them to go and fetch fire. The blind lovers scruple not to obey her commands ; and flying to the next fire or candle, are inevitably burnt to death. In the present day the poor inhabitants of Cuba ingeniously avoid the expense of wax or oil, by perforating a calabash with holes, and inclosing within it several of these insects. When they want to trim their insect lamps, they give it a gentle shake, when the brilliant beams of the insect light are redoubled in power. They also tie them to their toes.*

Ladies have worn these beautiful insects in

* See Frontispiece to this Chapter.

their hair, and upon their dress. In India they are often enclosed in little gauze nets, and form a brilliant part of the head-dress in evening time. In Italy they are also thus worn. In China an Imperial edict was, from some cause or other, issued to prevent young ladies adorning themselves with these brilliant beings.

Light-insects have sometimes played a not unimportant part in the history of nations. We are told by Mouffet, that when Sir Thomas Cavendish, and Sir Robert Dudley first landed in the West Indies, and saw in the evening an infinite number of moving lights in the woods, which were merely insects, they supposed that the Spaniards were advancing upon them, and made a precipitate retreat to their vessels. It is also related that when the troops of Cortez contended with those sent by Velasquez, to compel the former to return, they attacked them by night, and the soldiers of the latter were smitten with dismay at the apparently immense force brought by Cortez against them. The fact being that a multitude of luminous insects were descried by them, and mistaken for the lighted matches of troops of musqueteers.

The nocturnal splendour of luminous insects in tropical countries has nowhere been so beautifully described as in the following glowing lines of Southey's, who elsewhere describes the lamp by which Madoc beholds the features of his lovely guide, as a

“—Cage or net,
It rather might be called, so fine the twigs
Which knit it, where confined two fire-flies gave
Their lustre—”

The night scene is as follows:—

“Soon did night display
More wonders than it veiled: innumerable tribes
From the wood-cover swarmed, and darkness made
Their beauties visible. One while they streamed
A bright blue radiance upon flowers that closed
Their gorgeous colours from the eye of day;
Now motionless and dark, eluded search,
Self-shrouded: and anon, staining the sky
Shone like a shower of fire.”

In this account of the luminous properties of insects, all reference to species has been avoided, principally because there is much dispute among entomologists upon the subject. The majority of the foreign light-bearers belong to the family of the *Elateridæ*; our own glow-worm belongs to the family of *Lampyridæ*.

The evolution of electricity is a still more singular property possessed by some rare insects. At a meeting of the Entomological Society in May 1822, Mr. Yarrell exhibited a large and hairy caterpillar possessed of this remarkable faculty. This insect was seen crawling on the ground by Capt. Blakeney, R.N., in South America, and upon picking it up, he experienced a sensation similar to a violent electric shock. Such in fact was the force of this discharge, that it completely paralyzed his arm for some time, and his life was for a period endangered by the accident. No mention was made of the possession of any electrical organ in this insect, by which so powerful a charge of the electric principle could be developed.

With these digressive notices of various facts about insects generally, we must close our chapter on Insect Miscellanies,—which we may be allowed to add has borrowed nothing but the name from the pleasant volume written by Mr. Rennie, under a similar title. We have now to introduce the reader to the last part of the Life of an Insect,—its diseases and death.



CHAPTER XII.—INSECT SIXTENS.

CHAPTER XII.

INSECT DISEASES, AND DEATH.

“ Upon the fool, upon the wise,
 Sickness and health enter common :
 May none eschew that fortune.” GOWER.

INSECTS are no exceptions to this truth. Disease and death are common to all the inhabitants of a sin-sick world. Man and the brute creation lie alike under the curse, for disease and death came by sin, and no human power can stay their progress, or remove the penalty. The soul purified by the Redeemer's blood, and sanctified by his Spirit, is indeed freed from the bondage and consequences of sin ; but the body must still bear the consequences of our first parent's fall, and of that sin, which, entering into the world, caused “ all our woes.” In the restitution of all things to a happier state, so abundantly promised in the word of God, when

Christ the sun of righteousness, and the Mighty Regenerator of a fallen world, "shall arise with healing in his wings," the inhabitants of the land "shall no longer say I am sick." Disease, dark brooder over this fair creation, shall flap its heavy wings and flee away. There shall be no more sickness, nor any more death. Be it ours to seek a participation in those promised blessings; and to seek it in that way, along which the gospel sheds its pure and sacred light.

Few spectacles are more painful than to behold the brute creation, unendowed with the faculty of speech, as they to our comprehensions are, withering under the strong hand of agonizing sickness. And in consequence of their inability to communicate with us, beyond by dumb show, and of ours to do so with them, or to ascertain the nature of their disease in many cases excepting by its analogies with disease in our own frames, we probably know but a few of the maladies under which they suffer. Many a pang of agony must be endured, of which we are unconscious; the more unmistakable evidences of corporal suffering being alone

made manifest to our perceptions. It is true the sensibility of many creatures is low, and they can bear much more than ourselves, in consequence of the lower development of their nervous systems, without experiencing severe pain. This is particularly the case with insects whose nervous organization is not to be compared with that of man; and, consequently, whose endurance of suffering and perceptions of pain are much duller and more obtuse than our own. The poet was therefore clearly wrong when he wrote that

“—The poor beetle that we tread upon,
In corporal sufferance finds a pang as great
As when a giant dies,—”

if by these words he intended to convey the idea that the sensations of the one and of the other creature are equally acute. This, however, does not actually appear to have been his meaning, his intention having been rather to show that the pang of death is most in apprehension, the actual suffering being trivial.

Yet we must avoid the opposite extreme, into which some entomologists have fallen, of considering that insects cannot feel at all. Their sensa-

tions are far less acute, doubtless, than ours; but can we believe that God has created this beautiful division of the animal kingdom, so highly endowed with intelligence and skill, and has left them without the power of perceiving pleasure or pain? It is altogether irrational. The bluntness of the perceptive powers in insects, may be judged of, when we are told that insects, even after having been impaled with a pin, will devour their prey as greedily as if at liberty, and seem to suffer little inconvenience from the loss of half their bodies. But this by no means proves their total want of feeling. Let us, however, inform the reader of some of the insect maladies.

A very singular disease to which ants are subject, is *giddiness of the head*, or in scientific language, vertigo. This was noticed by Huber; "Ants have also their maladies," he writes; "I have noticed one, extremely singular; the individuals attacked by it, lose their power of guiding themselves in a straight line. They can walk only by turning round in a circle of small diameter, and always in the same direction. A female shut up in one of my glasses was seized

on a sudden with this distemper. She described a circle of an inch in diameter, and made about a thousand turns an hour, or not quite seventeen in a minute. She continued constantly turning round for seven days, and when I visited her in the night, she was still in motion. I gave her honey, and I think she ate some of it. I also found three workers, which turned round in this manner; one of them had, however, the faculty of walking occasionally in a straight line. I took this ant into my hand; it still continued to turn round, would now and then stop to taste a little honey, and then resume its circular movements." In some of the experiments made by physiologists on the brain, a remarkable consequence of cutting certain portions away was their tendency to spin round.

Towards the end of May and June, bees are often attacked with the same complaint. The sick insects fly, it is said, in a dizzy manner, and start and fall down, while pursuing their usual avocations. To these symptoms succeed lassitude and death. No physician of the bees, has hitherto found a remedy for this sad complaint. Bees are, however, subject to a worse

complaint, a sort of dysentery, which causes them to forget their usual habits of neatness. Dr. Bevan tells us that sometimes their antennæ become tumefied and diseased, and the bees becoming languid and feeble, die if they have not timely assistance. Occasionally, pestilence invades the bee-hive. The young larvæ die, and their putrefying bodies fill the bees' atmosphere with poisonous exhalations. The bees suffer severely from this state of things, and the hive becomes rapidly thinned, or perishes altogether if the combs infected with the disease are not cut out, and the bee-dwelling fumigated and cleansed.

The pharmacopœia for the bees is very short and simple, and the practice of medicine among them, in the hands of bee-keepers, is rude and imperfect. Sanitary measures are of the first consequence, and often are the only means necessary to employ in the removal of disease. Cleanliness and plenty of suitable food are strongly insisted on. But the bee-physician finds it useful now and then to give cordials to his little insect patients, and he accordingly treats them to sugared ale, and now and then a little drop of wine.

In the larva state insects are subject to several internal maladies. The cultivators of the silk-worm distinguish seven or eight different diseases to which this useful insect is subject during its passage from the larva into the pupa condition. The causes of these diseases are various. Sometimes the eggs appear to be in fault, sometimes the treatment of the insects with regard to food, ventilation, &c., and sometimes the food itself exerts an injurious influence upon them.

Insects are not unfrequently the subjects of disease, induced by the presence of parasites either in the interior or on the exterior of their bodies. A poor languid caterpillar crawling feebly up a paling, was taken into the writer's study and placed in a glass jar. After living for a few days, it fixed itself against the side of the glass, and appeared as if it were about to undergo its metamorphosis from the larva into the pupa. On examination in a short time afterwards a remarkable spectacle appeared. The body of the unhappy insect was burst open, and surrounding it, were ten or twelve bright yellow cocoons, evidently the residences of a similar number of parasites, who had long infested

and at length destroyed the poor insect. The observation of this fact caused great perplexity to the older naturalists, who could not imagine how a caterpillar, which ought to have turned ultimately into a butterfly, should become, as it were, the parent of a number of Ichneumons. These busy destroyers alight upon the unsuspecting insect, plunge their ovipositor into its tender body, there deposit their eggs, which are in due time hatched, and destroy the insect in which they reside, and then spin their golden cocoons, which ultimately give birth to winged insects, dispersing themselves on a similar errand of death to every caterpillar they meet with of a particular species. The clothes-moth caterpillar, fretting our garments, has a similar destroyer. The benefits thus conferred by these insects, in the destruction of the destroyers of our food and raiment, are altogether incalculable. Parasites frequently attach themselves to the exterior surface of insects to their destruction, or to their excessive annoyance. It is said, that the humble-bee, when attacked with parasites will go to an ant-hill, disturb the busy citizens, and provoke them to fall upon it, when

they seize the parasites and carry them off, thus ridding the insect of its annoyers.

A more remarkable class of parasites are those which are of vegetable origin. The common dung-fly may occasionally be noticed resting upon the stalk of a plant in the attitude of life, but on close examination it is found to be stiff, and quite dead, and its body here and there covered with a white dust resembling mould. So precisely is their attitude that of the living insect, which appears as if resting, that it frequently escapes observation. Sometimes this fly is found fast glued by its proboscis to leaves of plants, every other part of the insect being free. This has been explained by the fact that flies in an apparently dying state have been seen on the leaves of plants, emitting and again absorbing a drop of fluid at the end of the proboscis. Possibly the drying up of this fluid might glue the insect to the leaf. But more generally flies are seen affixed to the surfaces on which they are found, by the whitish mould with which they are infested. When this disease proceeds to its highest point, scarcely a trace of the insect is distinguishable, and there remains only a whitish

mass of downy material. Frequently we may observe the same fact without quitting the sitting room. Upon a neglected window pane, a dead fly often may be seen on the glass, around which a whitish cloud, like a very fine cobweb, exists.

It was long considered that this disease, for such in reality it is, was a mere plethora or over-fulness of the fly's body. The insects were thought to have eaten until their bodies were rent asunder! But it is now clearly ascertained that the disease is of a vegetable character, that it is, in fact, a species of fungus which vegetates on the fly's body, and increasing with great rapidity, destroys the power of life in the insect. This subject is highly interesting, and has been extensively investigated by various writers upon the Fungi. It surely must be considered as a most extraordinary circumstance that vegetable life, which is generally subject to animal vitality, should in this case get the mastery, and that the animal should become food for it, instead of the plant for the animal. It appears that the minute fungus, which has been called *Sporendomena muscæ*, attacks the insect while yet alive, rapidly extends its subtle threads, each of which

drains away the life juices of the insect, until finally the animal powers give up the unequal resistance, and the insect dies, overcome by the exhaustion of an inanimate invader. These fungi have been found in the air-cells of the lungs, and appear to enter far more largely into the structures of animals, under certain circumstances, than could have been anticipated. In all probability, where the insect is fatally attacked with fungi, or moulds, for the latter are only a different kind of these vegetable organizations, it must have been somewhat out of health before, the powers of life being thus reduced, and rendered less capable of resisting the invasion of disease.

Travellers inform us that in the West Indies insects resembling wasps are not unfrequently captured, the bodies of which are infested with a fungous plant. The insects are stated to be capable of flying about, although burthened with this parasite, and are often called the Vegetable wasps,—‘vegetating,’ would, however, be a more correct term. Certainly the poor insects present us with an extraordinary spectacle, a combination of a living animal and a living vegetable in one body. The plant, however, is victorious.

The insects become exhausted by its growth. Their bodies, up to their eyes, and down to the extremities of their feet, become literally filled with the fungus, and the insect dies so entirely metamorphosed into a vegetable as to all its internal organs, that in a less enlightened age, naturalists might well have been excused had they considered that the insect had been by some miracle of nature converted into a plant.

The breeders of silk-worms have a similar complaint to make against the vegetable world. Their unhappy insect charges are sometimes carried off to an alarming extent, by a malady which commences with the appearance of black points scattered over different parts of the body, or livid and blackish spots in the vicinity of the breathing apertures, or spiracles. These become of a reddish or yellow tint, and the insect dies. The name of this disease is *La Muscadine*. After death the body of the larva becomes so stiff and rigid as to be readily snapped asunder. Then they throw out from their surface a sort of white efflorescence, which is in fact the growth of the minute fungus, or *Botrytis*, which has destroyed them. Any healthy insects may be inoculated

with the same disease, by taking a few of the minute spores of the fungus from the dead insect, and inserting the needle laden with them a little under the skin. It soon sickens, languishes, and dies.

In a New Zealand caterpillar infested with fungous disease, the plant sometimes protrudes from the extremity of the insect, in a long delicate process, longer in fact than the insect itself. Mr. Westwood examined the interior of an insect thus diseased, and states that it was filled with a hard dry whitish matter, like the kernel of a nut. Dr. Buckland considered that the substance found in the interior of this caterpillar was vegetable, as it burnt with somewhat of the odour of hay, without any smell of animal matter. There is not a doubt, in fact, as to its belonging to the family of the fungi. In a large larva from South America, shown at a meeting of the Entomological Society, from the thorax a long, slender, and fantastically curved vegetable production protruded, nearly equalling the length of the body of the insect.

In addition to bodily diseases of various kinds as causes of death, besides falling a prey to in-

numerable devourers, and being destroyed by a variety of accidents, insects are sometimes killed by poison. We need not here advert to the dangerous draught prepared for poor flies by the sugar dealers and confectioners, or tell how the saucers are filled with an infusion of quassia, and how the latter becomes not only a bitter, but a fatal draught to the thirsty insects. Sometimes insects, of course involuntarily, poison themselves. In the "Gardener's Magazine," an observer states that he has observed the pavement under a blooming plant of *Periploca Græca*, to be literally covered with dead flies, of the same species as the house-fly; vast numbers of them at the same time swarming and settling on the flowers of the deadly vegetable. Bees are supposed sometimes to injure themselves by sucking the honey from the recesses of some empoisoned flower. Sometimes the honey they collect, as in the celebrated instance narrated by Xenophon, where a whole army was half poisoned, is injurious to the human constitution.

A strange instance of insects poisoning themselves, is narrated to have taken place in the plague of ants which in the year 1519 deso-

lated the Antilles. Among numerous attempts made to destroy the innumerable millions of these insects which overwhelmed the islands, we are informed that the Franciscans of La Vega placed a lump of corrosive sublimate, weighing three or four pounds, on the flat roof of the monastery. All the ants in the building at once ran to it, and, biting it, fell down dead; and as though messengers had been sent to invite all within half a league to the banquet, the roads were filled with them. They scaled the walls, and tasting the poison, fell dead like their companions, until the roof was blackened with them. This continued, as long as the sublimate lasted. Then the friars, says Mr. Doubleday, having found that they gained nothing by this experiment, save the bringing fresh swarms of ants, did not care to renew it.

Let us now bring the reader to the insect graveyard. Most strange is the fact that there is a species of beetle, represented in the frontispiece to this Chapter, which has the extraordinary propensity of burying every dead animal when practicable. M. Gleditsch has given a delightful account of several experiments made by him on these singular

insects. In fifty days four of these insect-sextons had interred twelve carcasses—*viz.* four frogs, three small birds, two fishes, one mole, and two grasshoppers, besides the entrails of a fish, and two morsels of the lungs of an ox. The beetles deposit their eggs in the bodies, and then with most extraordinary patience, perseverance, and ingenuity, proceed to inter them in the earth. One of the most recent and lively accounts of these insects is given by Rusticus, and we shall transfer his narrative of the circumstances he witnessed, from the pages of the “Entomological Magazine” to our own.

The common objects of search are dead mice, rats, birds, frogs, and moles; of these a bird is most commonly obtained. In the neighbourhood of towns, every kind of garbage that is thrown out attracts these beetles as soon as it begins to smell, and it is not unusual to see them settling in our streets, enticed by the grateful odours of such substances. The burying beetles hunt in couples, male and female; and when six or eight are found in a large animal, they are almost sure to be males and females in equal numbers. They appear to hunt by the

nose only, their movements being mostly made in the night, when the faculty of sight is of but little service.

Now, to a bullfinch (which lay dead on the ground, and had been visited by the male beetle) the beetle soon returned with his bride. Neither seemed at first to discover the exact spot; at last the male espied it, and great comfort he expressed, wheeling in circles about eighteen inches above it, in the manner of an eagle, only some miles nearer the earth: the female settled on it at once, without this testimonial of satisfaction. The male at last settled also, and the bird underwent the scrutiny of four at least of the senses—touch, smell, sight, and taste—for the heads of both were continually diving among the feathers of the bird, and a savoury and ample meal was made before the great work of burying was begun. After the beetles had appeased the calls of hunger, the bird was abandoned for a while, both of them examining with great care, the earth all round, to see whether it was a decent place for the funeral. Being satisfied as to the decorum of the position, the operation of burying was commenced by the

male; the female mounting the bird, and for a time sitting quietly upon it, then hiding herself among the feathers, and allowing herself to be buried with it. The male began by digging a furrow all round the bird, at a distance of about half an inch, turning the earth outside; his head was the only tool used in this operation, it was held sloping outwards, and seemed prodigiously powerful.

After the first furrow was completed, another was made within it, and the earth was thrown into the first furrow; then he made a third furrow, but this was under the bird, so that I could only see a bit of him now and then, and I could only judge for a long time of what was going on by the heaving of earth, which formed a little rampart round the bird. As the rampart rose the bird sank.* After three hours' incessant labour, the beetle emerged, crawled on the bird, and took a survey of his work. Here he remained about an hour still as death, he did not stir hand or foot; he then dismounted, dived again into the grave, and kept on pulling the bird down by the feathers for half an hour:

* See Frontispiece to this Chapter.

its own weight seemed to sink it but very little. The earth then began heaving and rising all round; it was for all the world like a little earthquake: the feathers of the bird were again pulled, and again the bird descended. At last, after about three hours' more labour, he came up, mounted on the bird, took a survey, and then dropped down to rest as though dead, or suddenly fallen fast asleep. When sufficiently rested, he roused himself, trod the bird firmly into its grave, pulled it by the feathers this way and that way, and having settled it to his mind, began to shovel in the earth: this he did in a very short time by means of his broad head. He went behind the rampart of earth, and pushed it into the grave with amazing strength and dexterity, his head being bent downward at first, and then the nose chucked up with a kind of jerk, which sent the earth forwards. After the grave was thus filled up, and the earth trodden in, it underwent another keen scrutiny all round, the bird being completely hidden; he then made a hole in the still loose earth, and having buried the bird, and his own bride, next buried himself.

Having eaten as much of the savoury food as

they please, they make their way out and fly away. In a short time the eggs are hatched, the larvæ feed upon the putrid remains, undergo their changes, and become as busy sextons as their parents were. This burying instinct is doubtless given to these creatures with a view to the removal of noxious matter from the surface, and the office of our sextons is one of no slight importance in the varied economy of creation. Let us go hence, and take our last illustration of the Life of an Insect from the dying bed of an insect sovereign.

A queen in a thinly peopled hive lay on a honeycomb, apparently dying. Around her dying couch were six affectionate workers, intently watching every movement of their expiring mistress. Now they would gaze earnestly on her, and gently quivering their wings, would endeavour to revive the lamp of life—now their sharp weapons would be thrust out as if to repel all intruders, and to secure to their monarch a peaceful dying moment. On presenting them with honey, although it was eagerly devoured by the careless mob outside, these affectionate watchers refused to taste the proffered banquet, so entirely

were they absorbed in their last mournful duty. The queen breathed her last. Yet, around her lifeless corpse, this faithful band of attendants still remained. A day passed by, but they relinquished not their charge, and another, and another, and still they kept watch, hungry and exhausted; yet refusing sustenance, and abiding still by the side of what was once the pride and glory of their hive—now a lifeless insect frame. Four days went by, and every individual of this little company had perished at its post,—death had kindly extinguished both their affection and their grief.

It is not less true of insects than of man, that

“A little rule, a little sway,
A sunbeam in a winter’s day,
Is all the proud and mighty have,
Between the cradle and the grave.”

Looking at our world merely with the eye of the naturalist, we see it is in the words of Bishop Hall, “a goodly place filled with all grateful objects to our senses, full of variety and pleasantness, and the soul fastening on them is ready with Peter in the mount to conclude, ‘That it

is good to be here.'” But as we look on Nature, we hear voices on every side telling us that, together with ourselves, all things possessed of life must die and return to dust. The monarch of old had felt no need of one to be ever calling to him—“thou art mortal,” had he looked and thought on things around him. The flowers fade and die, the brute creation close their allotted periods, and become earth again; and insects, after a life of sunshine spent in revelling on the wing through fields of air, languish with disease, or the victims of accident, go to the common resting-place of all things. Man with slower steps follows after: the mourners go about the streets. “Then shall the dust return to the earth as it was, and the spirit shall return unto God who gave it.”

R. E.

THE END.

LONDON:

Printed by SAMUEL BENTLEY & Co.

Baugor House, Shoe Lane.

Society

FOR

Promoting Christian Knowledge.

BOOKS SUITABLE FOR PRESENTS.

*Most of these Works may be had in ornamental bindings,
with gilt edges, at an extra charge of 6d. each.*

	Price.
	s. d.
AFRICAN KINGDOMS and PEOPLES, Sketches of the, with Map.	4 0
ALICE GRAY; or, the Ministrations of a Child . . .	2 0
AMY'S TRIALS; or, a Character Misunderstood . .	2 0
BARZILLAI; or, the Triumph of Mercy	1 0
BIBLE PICTURES and STORIES. With Colored Plates. In 2 Vols. each	3 0
BIRDS of the SEA-SHORE. 12 Colored Plates . .	1 8
BIRDS' NESTS, with 22 Colored Plates of Eggs. By the Rev. C. A. JOHNS	4 6
BRITISH SETTLEMENTS in INDIA, History of	4 0
BRITISH FISHES, A Familiar History of	4 0
BRITISH BUTTERFLIES. Colored Plates	1 8
BROKEN ARM, The	2 6
CHANNEL ISLANDS, Rambles among the	3 0
CHAPTERS on COMMON THINGS of the SEA- SIDE. By ANNE PRATT	4 0
CHEMISTRY of CREATION	5 0

(Demy 16mo.)

BOOKS SUITABLE FOR PRESENTS.

	Price. s. d.
DEWDROP and the MIST: an Account of the Phenomena and Properties of Atmospheric Vapour in various Parts of the World. By CHARLES TOMLINSON, Esq. New Edition	3 6
ELDAD the PILGRIM	3 0
EVENINGS at the MICROSCOPE. By P. H. GOSSE, F.R.S.	8 0
FIRESIDE TALES. 2 Vols.	3 6
FLOWERS of the FIELD. By the Rev. C. A. JOHNS	7 0
FOREST TREES. 2 Vols. By Ditto	7 6
GARDENING for CHILDREN. By Ditto	2 0
HANNAH LAVENDER; or, Ladyhall	1 8
HARRY'S BATTLES; and how he fought them	1 0
HISTORY of ENGLAND, for Young Persons	2 0
HYMNS and PICTURES. 16 Colored Plates, <i>gilt edges</i>	4 0
ILLUSTRATIONS of USEFUL ARTS, MANUFAC- TURES and TRADES. By CHARLES TOMLINSON, Esq. 1300 Woodcuts. In 1 Vol. 4to.	8 0
LIFE of NELSON	2 6
LIFE of WELLINGTON	2 0
MARGARET ARNOLD. A Tale.	2 0
MARGARET LESLIE.	2 6
MARY GROVE	2 6
MONTHLY FLOWER GARDEN, The. Edited by the Rev. C. A. JOHNS. 12 Colored Plates	1 8
MONTHLY GLEANINGS from the FIELD and GARDEN. Edited by Ditto. 24 Colored Plates	3 6
MONTHLY WILD FLOWERS. Edited by Ditto	1 8
MONTHLY WINDOW FLOWERS. Edited by Ditto	1 8

BOOKS SUITABLE FOR PRESENTS.

	Price.	
	s.	d.
NELLIE and ALICE	1	0
NICHOLLS' HELP to READING the BIBLE . .	2	6
OCEAN, The. By P. H. Gosse, F.R.S.	4	6
OUR NATIVE SONGSTERS. By ANNE PRATT.		
73 Colored Plates	8	0
PARIS, RAMBLES ROUND. By Rev. C. A. JOHNS	3	0
PICTURE BOOKS for CHILDREN—ANIMALS.		
By Ditto	1	0
PICTURES and STORIES for LITTLE CHILDREN.		
By ISABELLA E. GLENNIE	1	0
PITCAIRN: the Island, the People, and the Pastor.		
By the Rev. T. B. MURRAY, M.A.	2	0
POISONOUS, NOXIOUS, and SUSPECTED PLANTS.		
By ANNE PRATT. 44 Colored Plates . .	6	0
READINGS from ENGLISH HISTORY, for CHILDREN	2	0
ROBINSON CRUSOE	4	0
SCENES and NARRATIVES from GERMAN HISTORY	2	0
SCENES in the CAMP and FIELD; being Sketches of the War in the Crimea	2	0
SCRIPTURE MANNERS and CUSTOMS	4	0
SCRIPTURE NATURAL HISTORY	4	0
SCRIPTURE TOPOGRAPHY—PALESTINE and GENTILE WORLD	6	0
SELBORNE, NATURAL HISTORY of. By the late Rev. GILBERT WHITE, A.M. Arranged for Young Persons. A new and revised Edition	6	0
SHIPWRECKS and ADVENTURES at SEA . .	3	0
SHORT STORIES founded on EUROPEAN HISTORY.—FRANCE, ITALY, SPAIN, SWEDEN, SWITZERLAND	2	0

BOOKS SUITABLE FOR PRESENTS.

	Price	
	s.	d.
SISTERS, The. By Mrs. TOMLINSON	2	0
SKETCHES of RURAL AFFAIRS	3	6
STORIES from ROMAN HISTORY	3	0
———— for the NURSERY	2	6
TEACHERS and TAUGHT	1	0
TEMPEST, The; or, an Account of the Nature, Properties, Dangers, and Uses of Wind in various Parts of the World. New Edition	3	6
TEXT BOOK of ZOOLOGY. By P. H. GOSSE, F.R.S.	3	6
THUNDER-STORM, The. By C. TOMLINSON, Esq. New Edition. Fcap. 8vo.	3	6
TRAVELS by LAND and SEA; The Old Arm Chair, or	3	0
TWINS, The; or, Home Scenes	1	8
TWO FIRESIDES, The. A Tale	2	0
WILD FLOWERS. By ANNE PRATT. 2 Vols. 192 Colored Plates	16	0
YEAR of COUNTRY LIFE; or, Chronicle of the Young Naturalists	2	6

An Allowance of 25 per Cent. to Members.

DEPOSITORIES:

77, Great Queen Street, Lincoln's Inn Fields; 4, Royal Exchange;
16, Hanover Street, Hanover Square.



